

Hemlock Public Schools

PROJECT MANUAL

Hemlock Public Schools

Bid Package #1



January 3, 2023

ARCHITECTS/ENGINEERS

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Telephone: 616-456-9944
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CONSTRUCTION MANAGER

Wolgast Corporation
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Bidding Requirements, Contract Forms, and Conditions of the Contract

00005 – Index
00010 – Notice to Bidders
00100 – Instructions to Bidders
00300 – Instructions – Proposals/Bid Division Descriptions
00305 – Proposal Form
00306 – Familial Relationship Affidavit
00307 – Iran Business Relationship Affidavit
00309 – Bid Division Descriptions
00310 – Clarification Request Form
00410 – Bid Security
00500 – Notice to Proceed/Commencement of Work
00510 – Sample Owner/Contractor Agreement
00600 – Bonds
00650 – Certificates of Insurance/Sample Form
00670 – Schedule of Values
00680 – Subcontractor, Supplier, Material, Equipment
00690 – Employee Listing
00700 – General Conditions of the Contract for Construction – AIA A232
00900 – Addenda
00999 – Milestone Schedule

Division 1 – General Requirements

01010 – Summary of Work	01520 – Construction Aids
01030 – Project Work Hours	01530 – Safety
01040 – Project Administration	01540 – Security
01045 – Contractor Applications for Payment	01550 – Access and Deliveries
01050 – Sworn Statements/Waivers	01560 – Temporary Controls
01051 – Change Events	01570 – Traffic Regulation
01053 – Change Orders	01580 – Project Informational Signs
01055 – Field Engineering	01590 – Project Field Office
01060 – Prevailing Wage	01600 – Material and Equipment
01085 – Applicable Standards	01700 – Contract Closeout
01100 – Alternates	01710 – Cleaning
01200 – Project Meetings	01720 – Record Documents
01300 – Submittals	01730 – Operating and Maintenance Data
01350 – Schedules	01740 – Guaranties and Warranties
01400 – Quality Control	01800 – Hazardous Materials Affidavit of Non-Use
01410 – Testing Services	01805 – AHERA Notification
01510 – Temporary Utilities	01900 – Demolition and Removal

END OF SECTION 00005

Hemlock Public Schools will receive sealed bid proposals for construction trade work from qualified contractors for the **Hemlock Public Schools, Bid Package #1**. A pre-bid meeting and project walk-through will be conducted by the Construction Manager, Wolgast Corporation, and the Architect, **Tower Pinkster**, on **January 11, 2023**, at **3:00 PM** (local time) at **Hemlock High School Media Center/Library/Commons located at 733 N. Hemlock Rd., Hemlock, MI 48626**.

Proposals may be mailed or delivered in person to **Don Killingbeck, Superintendent**, c/o **Hemlock Public Schools, 200 Wilson St, Hemlock, MI 48626**. Proposals must be received prior to **1:00 PM**(local time) on **January 20, 2023**, at the **Hemlock Public Schools Administration Building**. Proposals will be publicly opened and read aloud at **1:15 PM** in the **Hemlock High School Media Center/Library/Commons located at 733 N. Hemlock Rd., Hemlock, MI 48626**. All bids will be evaluated after the bid opening. All bids received after **1:00 PM** of the bid date will be returned to the Bidder unopened.

The Project will utilize separate prime contractors. All contracts for construction will be direct contracts with the Owner. Overall administration of the Project will be the responsibility of the Construction Management Firm, Wolgast Corporation, 4835 Towne Centre, Suite 203, Saginaw, Michigan 48604, Phone: (989) 790-9120, Fax: (989) 790-9063. The Owner will award contracts on or about **February 1, 2023**, to separate prime contractors for separate bid divisions or combinations of bid divisions. A Bidder may submit a proposal on more than one Bid Division; however, a separate bid must be submitted for each Bid Division of a combined bid. All bids shall be submitted on the bid forms provided in the project specifications, completely filled in, and executed (copies of the bid forms are acceptable). Facsimile bids will not be accepted.

The Bidders shall read and review the Bidding Documents carefully, and familiarize themselves thoroughly with all requirements.

Requests by Contractors for inclusion, as Bidders shall be addressed to Wolgast Corporation. One (1) set of Bidding Documents will be provided to each contractor furnishing a plan deposit fee of **\$100.00** per paper set or No Cost for electronic documents through Wolgast Corporation. All checks and/or money orders are to be made payable to the **Hemlock Public Schools**. Plans may be obtained from Wolgast Corporation, attention **Donna Ratzlaff**. Plan deposits are refundable, provided plans and specifications are returned in good condition to the Construction Manager following contract awards. All questions regarding the bidding procedures, design, and drawing/specification intent are to be directed to the Construction Manager on a Clarification Request Form (Section 00310), attention **Craig Myers**.

A Bid Security by a qualified surety authorized to do business in the state where the Project is located in the amount of five percent (5%) of Base Bids shall accompany each proposal or proposal combination. The Bid Security may be in the form of a Bid Bond, Cashier's Check, or Money Order. Personal checks are NOT acceptable. Bids may not be withdrawn for a period of sixty (60) days after the bid date. Successful Bidders may be required to furnish Surety Bonds as stated in the Project Specifications (Section 00600).

The Owner reserves the right to reject any or all proposals, accept a bid other than the low bid, and to waive informalities, irregularities, and/or errors in the bid proposals, which they feel to be in their own best interest.

All bidders must provide familial disclosure in compliance with MCL 380.1267 and attach this information to the bid. The bid shall be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the Owner or the employee of the bidder and any member of the board, intermediate school board, or board of directors or the superintendent of the school district, intermediate superintendent of the intermediate school district, or chief executive officer of the public school academy. The District shall not accept a bid that does not include this sworn and notarized disclosure statement.

END OF SECTION 00010

PART 1 – GENERAL

1.01 DEFINITIONS

- A. The Owner is: **Hemlock Public Schools.**
- B. The Architect is: **Tower Pinkster.**
- C. The Construction Manager is: **Wolgast Corporation.**
- D. The Project Team consists of the Construction Manager, the Architect, and other design professionals providing services in connection with the project.
- E. The Project is: **Hemlock Public Schools, Bid Package #1**
- F. Work is any portion of the Project.
- G. The Bidding Documents include (as applicable to the Project):
 - 1. The Notice to Bidders.
 - 2. The Instructions to Bidders.
 - 3. Bid Division Descriptions.
 - 4. Proposal Forms.
 - 5. Sample Contract Forms.
 - 6. The Specifications for the Project.
 - 7. The Drawings for the Project.
 - 8. All Addenda issued for the Project.
 - 9. The Preliminary Milestone Schedule.
- H. Addenda are written and/or graphic instruments issued by the Architect, which add to, delete from, clarify, or correct the Bidding Documents.
- I. Bids are sums stipulated in Proposals for which Bidders propose to perform the Work of Bid Divisions.
- J. Base Bids are sums stipulated in Proposals for which Bidders offer to perform the Work of Bid Divisions, and which Alternate Bids may be added to or deleted from.
- K. Alternate Bids are sums that may be added to or deleted from Base Bids for the performance of Alternate Work, as delineated in the Bidding Documents.
- L. Unit Prices are sums included in Proposals as Bids per unit measure of materials and/or services, as required by the Bidding Documents.
- M. Proposals are complete, properly executed forms including Base Bids, Alternate Bids, Unit Prices, and other information requested by the Owner.
- N. Bidders are pre-qualified contractors who submit proposals to the Owner for Work as Prime Contractors on the Project.
- O. Bid Divisions are the divisions of Work into which the Project is divided for bidding. Bid Divisions shall not be confused with Technical Specification Divisions.
- P. Bid Division Descriptions (Section 00309) are written descriptions of the Work included in the Bid Divisions.

1.02 MULTIPLE PRIME CONTRACTS/BID DIVISIONS

- A. This is an Owner Represented Project. There is no General Contractor. All contracts awarded on the Project shall be prime contracts. The Owner will award contracts for each Bid Division and/or for groups of Bid Divisions. The Construction Manager will administrate the Project.
- B. Although each Bid Division involves an obvious and recognizable segment of “conventional” trade contracting, multiple contract project delivery requires that adjustments be made to permit the completion of each Bid Division as a separate segment of construction. Each bidder shall carefully review the total scope of their responsibilities with respect to the Work of their Bid Division(s), and shall provide for the total scope in their Proposal.
- C. Bid Division Descriptions (Section 00309) have been written to clearly delineate each Bid Division. The Owner is not responsible for a Bidder’s interpretation of the Bid Division Descriptions. Bidders are encouraged to request information by calling or emailing the Project Manager:

Craig Myers, Project Manager, Wolgast Corporation, (989) 790-9120, extension **717** or cra.mye@wolgast.com .

- D. For the purpose of clarity, the scope of work for each Bid Division may be divided into four categories: “GENERAL INCLUSIONS,” “DIVISION INCLUSIONS,” “PROJECT INCLUSIONS,” AND “EXCLUDED.”
1. Information provided under the heading “GENERAL INCLUSIONS” is the obvious and/or “conventional” work scope of each Bid Division.
 2. Information provided under “DIVISION INCLUSIONS” or “PROJECT INCLUSIONS” points out items which may be considered less obvious or “unconventional,” but which are included in the work scope of a particular Bid Division. (Information under these headings are not always necessary to delineate a Bid Division.)
 3. Information provided under “EXCLUDED” is for the purpose of indicating beginning and termination points, and/or to provide an understanding of fringe involvement included in Bid Divisions. (Information under this heading is not always necessary to delineate a Bid Division.)
- E. **Bidders shall construe nothing contained in the Bidding Documents, including the Bid Division Descriptions, as an assignment of work to any construction industry trade. Each Bidder is responsible for their own work assignments when making their proposal.**

1.03 INTERFACING BID DIVISIONS

- A. Each Bidder shall familiarize themselves with the work scope of all Bid Divisions that interface with their own. Each Bidder shall consider that the work of their Bid Division(s) may follow the work of another Division or other Divisions, and that other Contractors may perform work after the work of their Bid Division(s), and that other Contractors may work simultaneously with the work of their own Bid Division(s). Each Bidder shall include provisions for such interfaces and for cooperation with interfacing Contractors in their Proposal.

1.04 PRE-BID CONFERENCE

- A. **Hemlock High School Media Center/Library/Commons located at 733 N. Hemlock Rd., Hemlock, MI 48626
January 11, 2023 at 3:00 PM**

1.05 BIDDING DOCUMENTS

- A. Qualified Bidders have received sets of Bidding Documents. Requests from Bidders for additional sets of Bidding Documents will be honored under the conditions set forth in the Notice to Bidders (Section 00010).
- B. Following the award of construction contracts for the Project, all sets of Bidding Documents, plans, and specifications, except sets in possession of Contractors who have been awarded contracts, shall be returned to the Project Team.
- C. Bidders who return sets of Bidding Documents, plans, and specifications, in reasonably good condition shall have their plan deposit returned within ten (10) days of the Project Team's receipt of the documents.
- D. Bidders shall use complete sets of Bidding Documents in preparing Proposals. Bidders are responsible for ascertaining that the Bidding Documents upon which their Proposals are based are complete.
- E. Bidding Documents are provided to Bidders for uses pertaining to bidding only. No other use is permitted.
- F. Bidders shall promptly notify the Project Team of any ambiguities, inconsistencies, errors, and/or omissions they may discover in the Bidding Documents.
- G. Requests from Bidders for clarification or interpretation of the Bidding Documents must reach the Project Team five days before the bid date or by the date addressed in the pre-bid agenda. Any bidder clarifications which reach the Project Team after such dates have passed will not be considered.
- H. Changes and corrections to the Bidding Documents will be made by Addendum, and distributed to Bidders.
- I. Each Bidder shall ascertain prior to submitting their Proposal that they have considered every Addendum issued prior to the Bid Date, and shall acknowledge receipt of each Addendum in writing in their Proposal.

1.06 PRELIMINARY MILESTONE SCHEDULE

- A. The Preliminary Milestone Schedule is Section 00999 of this Project Manual.
- B. A Preliminary Milestone Schedule has been developed by the Construction Manager and supplied to the Bidders. Each Bidder is required to review the dates indicated in that Schedule, and either endorse or amend them within the context of the Bid Division(s) they are bidding. Space is provided on the Proposal Form for endorsement or amendment. The Milestone Schedule and the information it provides are not part of the Contract Documents.
- C. The milestone dates as endorsed and/or amended by successful bidders and accepted by the Owner will be used in the development of a Master Schedule to be used as a guide during the construction of the Project.
- D. Each Bidder is obligated to comment, in writing, on the Milestone Schedule if, in their opinion, the dates do not depict realistic time interval(s) for performance of the Work of their Bid Division(s)
- E. The effect of endorsements of and amendments to the Milestone Schedule will be considered when selecting Bidders for contract awards.

1.07 BID SECURITY

- A. Bid Security is required for this Project in the amount of five percent (5%). A surety company licensed, as such, to do business in the State of Michigan, must issue the Bid Bond, and all other Bonds. For additional information and instructions regarding Bid Security, refer to Section 00410.

1.07.1 AFFIDAVITS ACCOMPANYING BID PROPOSALS

- A. All Bid Proposals shall include the Familial Affidavit form (see Section 00306 – Familial Affidavit) to be included as part of the Bid Proposal.
- B. All Bid Proposals shall include the State of Michigan required Iran Economic Sanctions Affidavit form (see Section – 00307 – Iran Economic Sanctions) to be included as part of the Bid Proposal.

1.08 SUBSTITUTIONS

- A. The materials, products, and equipment described in the Bidding Documents establish the quality standard, required function, dimensions, and appearance, which shall be met by all substitutions.
- B. Contractors may request items not included in the construction bid documents be considered for inclusion as acceptably specified items by submitting a written request to the Project Team addressed to the Construction Manager not later than ten (10) days prior to the bid date. The Construction Manager will forward these written requests to the Architect who will make the determination whether the requested item is an acceptable “equal”. These acceptable “equal” items will be identified as acceptable by their inclusion in a written Addendum.
- C. Each substitution request will include a complete description of the proposed substitute, drawings, cuts, performance and test data, the name of the material or equipment for which it is to be substituted, and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment, or Work that incorporation of the substitute would require should also be included. The burden of proof of the merit of the proposed substitute is upon the Bidder. The Architect’s approval or disapproval of a proposed substitution shall be final.
- D. The bidder’s Base Bid contained in the Bid Proposal Form shall be the exact items contained in the construction bid documents (plans, specifications or addenda). The Base Bid contained in the Bid Proposal Form shall not include any substitute items not allowed in the construction bid documents.
- E. Bidders that have other substitutions to be considered for inclusion in the Project must identify them as Voluntary Alternates in the portion of the Bid Proposal Form so designated. The identity of these items must include the all product information and the dollar amount of increase or decrease associated with each individual substitute item.
- F. By making requests for any substitution, the Contractor represents:
 - 1. The Contractor has personally investigated the proposed substitution product and determined that it is equal to or superior to the product specified;
 - 2. The Contractor will provide the warranty for the substitution as the product specified;
 - 3. The cost data presented is complete and includes all related costs required for it to be incorporated into the Project including costs for additional Architectural and/or Construction Management services.
- G. The Architect will reply in writing to the Contractor, through the Construction Manager, stating whether the Owner or Architect, after due investigation, has reasonable objection to any substitution request. The decision of the Architect shall be final

1.09 VOLUNTARY ALTERNATES/VALUE ENGINEERING SUGGESTIONS

- A. Base Bids and Alternate Bids shall be based upon the Bidding Documents, including approved substitutions, and on the Bidders’ evaluation of the Project Site. However, the Owner invites Voluntary Alternates or Value Engineering suggestions consistent with the intent of the Bidding Documents. Such Alternates and suggestions, if submitted, shall be incorporated into Proposals by describing Voluntary Alternate(s) on company letterhead and attached to the Bid Proposal Form.

1.10 BID OPENING AND CONTRACT AWARDS

- A. Bids will be opened publicly after the time and date established for receipt of Proposals. Bid Summaries will be made available to Bidders by request after the Bid Date, but not before Post Bid Interviews have been conducted.
- B. Contract awards will be based on Bidders' Proposals and ability to perform. The Owner intends to award contracts to Bidders who submit proper Proposals in accordance with the requirements of the Bidding Documents.
- C. Decisions regarding Bidders abilities affecting contract awards will be made by the Owner.
- D. The Owner reserves the right to waive any informality or irregularity in any Proposal.
- E. The Owner reserves the right to reject any Proposal.
- F. All awards will be made in the Owner's best interest.

1.11 POST-BID INTERVIEWS

- A. Bidders in contention for contract awards will be required to attend Post-Bid Interviews and submit post-bid submittals in rough draft for review.

1.12 POST-BID SUBMITTALS

- A. Bidders who have been notified of the Owner's intent to award a contract shall submit the following items to the Construction Manager:
 - 1. A Schedule of Values utilizing the level of detail requested by the Owner (reference Section 00670).
 - 2. A list of all subcontractors and suppliers to be used, and all items of material and equipment to be incorporated into the Project (reference Section 00680).
 - 3. The name(s) of the on-site supervisor(s) whom the Bidder proposes to employ to accomplish the Work (reference Section 00690).
 - 4. Sample copies of the construction contracts are included in Sections 00510.

1.13 OWNER'S RIGHT TO APPROVE SUPPLIERS, SUBCONTRACTORS, MATERIALS, EQUIPMENT, AND EMPLOYEES

- A. Bidders will be required to establish, to the satisfaction of the Owner, the reliability and responsibility of proposed employees, suppliers and subcontractors, and the suitability of proposed materials and equipment.
- B. Prior to the award of a contract, the Construction Manager will notify the Bidder if the Owner has reasonable and substantial objection to any person, organization, material, or equipment listed by the Bidder. If the Owner has a reasonable and substantial objection, the Bidder shall amend their Proposal by providing an acceptable substitute. The Owner may, at their discretion, accept such a substitute, or they may disqualify the Proposal.
- C. Suppliers, subcontractors, employees, materials, and equipment proposed by the Bidder and accepted by the Owner shall be used on the Work for which they are proposed and accepted, and shall not be changed except with the written approval of the Owner.

1.14 BONDS

- A. Refer to Section 00600 for information and instructions regarding the bond requirements of this Project.

1.15 INSURANCE

- A. Refer to Sections 00650, and 00700 for information and instructions regarding insurance requirements for this Project.

PART 2 – FORMS FOR BIDDING

2.0 PROPOSAL FORMS

- A. Bidders are required to use the forms provided by the Owner for bidding purposes.
- B. Sample form(s) and instructions are in Section 00305 of this project manual.

PART 3 – PROCEDURES AND CONDITIONS FOR BIDDING

3.01 COMPLETION OF PROPOSAL FORMS

- A. Refer to Section 00300 for detailed information and instructions regarding completion of Proposal Forms.

3.02 SUBMISSION OF PROPOSALS

- A. Proposals shall be submitted to:

**Hemlock Public Schools
Don Killingbeck, Superintendent
200 Wilson St
Hemlock, MI 48626**

(Refer to Section 00010 – Notice to Bidders for additional information and instructions regarding the location for submittal of Proposals.)

- B. Proposals shall be submitted by **1:00 PM on January 20, 2023.**

(Refer to Section 00010 – Notice to Bidders for additional information and instructions regarding the date and time of submittal of Proposals.)

- C. **Bidders shall bear full responsibility for delivering Proposals to the required location by the time and date established.**

3.03 MODIFICATION OR WITHDRAWAL OF PROPOSALS

- A. A Proposal may not be modified, withdrawn, or cancelled by the Bidder within sixty (60) days following the time and date designated for the receipt of Proposals and the Bidder so agrees in submitting their Proposals.
- B. Prior to the time and date designated for receipt of Proposals, Proposals may be modified or withdrawn. Modifications and withdrawals shall be in writing or by telegram. If by telegram, written confirmation shall have been mailed and postmarked before the date and time set for receipt of Proposals. Telegraphic communications shall be worded so that the amounts of the original Proposals are not revealed.
- C. Withdrawn Proposals may be resubmitted up to the time and date designated for receipt of Proposals.

3.04 BIDDERS' REPRESENTATION AND ACKNOWLEDGEMENTS

- A. In submitting their Proposal, each Bidder represents that:
1. They have read and understand the Bidding Documents.
 2. Their Proposal is made in accordance with the Bidding Documents.
 3. They have visited the Project Site and have familiarized themselves with the local conditions under which the Work they are bidding will be performed.
 4. **They will accept the contract award, regardless of the identity of other Contractors on the Project.**
 5. **During contract performance, they will not interrupt their Work nor impede the progress of other Contractors as a result of prejudice based on sex, race, color, creed, labor affiliation, or lack of labor affiliation of Contractors or employees of Contractors engaged on this Project.**
- B. In submitting their Proposal each bidder acknowledges:
1. The right of the Owner to accept or reject any Proposal, to waive any informality or irregularity in any Proposal received, and to accept other than the low Bid.
 2. The right of the Owner to accept any combination of Bid Divisions they desire.
 3. The right of the Owner to award contracts in their own best interest.

3.05 OTHER INFORMATION

- A. All Bidders shall comply with the requirements of the Bidding Documents, Addenda, and all applicable codes, laws, and regulations in preparing and submitting their Proposals.
- B. Refer to Section 00300 – Instructions for Proposals and Bid Division Descriptions for additional information and instructions regarding Proposals.

END OF SECTION 00100

PART 1 – GENERAL

1.01 PROPOSAL FORMS

- A. A separate set of Proposal Forms, Bid Division Descriptions, Drawings, Contract Conditions, Specifications, and Preliminary Milestone Schedule(s).
- B. Bidders shall use the copies of Proposal Forms included in the separate sets of Bidding Documents. Copies of the Proposal Forms are acceptable.

1.02 BID DIVISION DESCRIPTIONS

- A. Section 00309 contains the Bid Division Descriptions. Each Bid Division Description represents a separate, self-contained Scope of Work. Bid Divisions are the basic divisions of Work into which the Project has been divided for bidding and construction.

PART 2 – PROPOSAL FORMAT

2.01 BID PROPOSALS

- A. Bidders are required to use the Proposal Forms provided by the Owner.
- B. A complete Proposal consists of:
 - 1. **Submit 1 complete copy of your proposal on Proposal Form – Section 00305.**
 - 2. Alternate Pricing forms (if applicable to this Project).
- C. Each Proposal shall have a Bid Security in the amount of five percent (5%) attached to the proposal.
- D. All spaces provided on the Proposal Form(s) shall be filled in. If any space provided is not utilized by the Bidder, that space shall be filled in with the notation “N/A” (Not Applicable).
- E. The Proposal Form(s) shall be filled in by typewriter or printed manually in ink.
- F. Where indicated, all sums shall be expressed in words and figures.
In case of discrepancy, the words shall govern.
- G. **Bidders shall not make unsolicited notations or statements on the Proposal Form(s). Alteration of the Proposal Form(s) is not permitted.**
- H. All changes to and erasures of the Bidder’s entries shall be initialed by the signer of the Proposal.
- I. Each Proposal shall include the legal name of the Bidder and a statement regarding whether the Bidder is a sole proprietor, a partnership, a corporation, or other type of legal entity. Proposals submitted by corporations shall have the state of incorporation noted, and shall have corporate seals affixed. Any Bid submitted by an agent shall have a current Power of Attorney attached, certifying the agent’s power to bind the Bidder.

2.02 ALTERNATES

- A. **All requested Alternates shall be bid with all lines completed or the Proposal will be considered incomplete.**

PROPOSAL FOR MULTIPLE BID DIVISIONS

- A. Each Bidder shall submit only one (1) Proposal for each Bid Division the Contractor is bidding. There is no limit to the number of Bid Divisions a Bidder may bid.
- B. Each Bidder is required to include a separate Bid for each Bid Division in order to be considered for contract award. Spaces are provided in the Proposal Form(s) to reference multiple Proposals.
- C. Multiple Bid Proposals shall contain separate Proposal Forms for each Bid Division being bid.
 - 1. Each Proposal Form shall be fully completed.
 - 2. The Bid for each Bid Division shall be independent of Bids for other Bid Divisions.
 - 3. Bidders shall use the "Combined Bid Deduct" section of the Proposal Form (Section 00305) to finalize multiple Bid Proposals.

PART 3 – COMPLETION OF PROPOSAL FORMS AND SEALED BID ENVELOPE

3.01 PROPOSAL FOR (SECTION 00305)

- A. Each Bid Division shall be submitted in a separate envelope, with a separate Bid Bond.
- B. Fill in the legal name of the Bidder, the address, the telephone number, fax number, contact name and contact email.
- C. Fill in the name and number of the Bid Division covered by the Proposal.
- D. Fill in the numbers and dates of all Addenda issued, received, and considered a part of the Proposal. Proposals must include acknowledgement of all Addenda issued up to the Bid Date.
- E. On the Proposal Form(s), fill in the Lump Sum Base Bid for the Bid Division. Fill in the amount in both words and figures. DO NOT include costs for Performance Bonds or Labor/Materials Payment Bond in the Base Bid amount.
- F. Fill in the cost(s) for Performance Bond(s) and Labor and Material Payment Bond(s) in the amount(s) requested (reference Section 00600), in the space(s) provided. Fill in the amount(s) in both words and figures.
- G. In the "Combined Bid Deduct" portion of the Proposal Form(s), state the amount(s) to be deducted from the total of your Base Bid should you be awarded contracts for multiple Bid Divisions. State the numbers of the Bid Divisions included in each combination, and the amount to be deducted from the total of all Base Bids in each combination.
- H. If Alternate Bid(s) have been requested, fill in the Lump Sum Bid for each Alternate Bid in the space provided. DO NOT include costs for Performance Bonds or Labor and Material Payment Bonds.
- I. Fill in the anticipated date(s) of indicated Shop Drawings and/or Sample Submittal(s) in the space(s) provided.
- J. Fill in the anticipated number of weeks needed for fabrication of indicated items, beginning on the Bid Date.
- K. Fill in the anticipated number of on-site staff.
- L. Fill in the anticipated number of days to complete the Work.
- M. Fill in the anticipated number of weeks needed for delivery of indicated items, beginning on the Bid Date.
- N. Fill in the names of the manufacturers, suppliers, and/or subcontractors of indicated items.

- O. If you choose to submit Voluntary Alternates or Value Engineering Suggestions, please summarize your suggestions and state the amount to be deducted from the Base Bid.
- P. Review the "Bid Division Responsibilities" portion of the Proposal Form.
- Q. Review the "Schedule" portion of the Proposal Form.
- R. If the Proposal includes exceptions or substitutions to any part of the Bidding Documents or the Contract Documents, state the exceptions or substitutions in writing on the Proposal Form.
- S. Fill in the Bidder's legal name.
- T. Indicate the Bidder's status as a sole proprietor, partnership, corporation, or other type of entity.
- U. Sign the Proposal Form in the space provided.
- V. Type or print the signer's name and title in the spaces provided below the signature line.
- W. Date the Proposal Form in the space provided.
- X. Provide phone number, fax number and email address on the space provided.

3.02 SEALED BID ENVELOPE

- A. Bids submitted must be sealed, preferably in a 9" x 12" manila envelope.
- B. Each Bid Division is to be submitted in a separate envelope.
- C. **Label the sealed bid as follows:**

<p>TO:</p> <p>Hemlock Public Schools Attn: Don Killingbeck 200 Wilson St Hemlock, MI 48626</p> <p><u>SEALED BID FOR:</u></p> <p>Hemlock Public Schools Bid Package #1</p> <p>Bid Division No: _____</p>
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END OF SECTION 00300

**Project: Hemlock Public Schools
Bid Package #1**

Submitted By: _____
(Bidder's Company Name)

Address: _____

City / State / Zip: _____

Phone: _____

Fax: _____

Contact Name: _____

Email: _____

Bid Proposal Deadline: Prior to January 20, 2023 at 1:00 PM (local time) to:

**Hemlock Public Schools
Don Killingbeck, Superintendent,
200 Wilson St
Hemlock, MI 48626.**

Bid Division Name: _____

Bid Division Number: _____

ADDENDA

We (the Bidder) acknowledge receipt of the following Addenda:

- Addendum #__ Dated _____
- Addendum #__ Dated _____
- Addendum #__ Dated _____

BID BOND ATTACHED?

- Yes, 5% Bid Bond is Attached**
- Certified Check/Money Order for 5% of Base Bid is Attached**

BASE BID for Hemlock Public Schools (not including Labor Bond, Material Bond, and/or Performance Bond Costs):

_____ Dollars and 00/100ths

\$ _____

BOND COST for Hemlock Public Schools (Cost to provide Labor Bond, Material Bond, and/or Performance Bonds on Base Bid):

_____ Dollars and 00/100ths

\$ _____

Base Bid: Per Project			
Price Breakdown	BASE BID	BOND	TOTAL
K. C. Ling Elementary School			
Stadium Turf			
TOTAL			

COMBINED BID DEDUCT

If awarded a contract for the Work, combining the following Bid Division(s), the corresponding amount(s) may be deducted from the Base Bid(s) of each of the involved Bid Divisions.

Bid Divisions Combined

Deduct from each Bid Division:

ALTERNATES

K.C. Ling Elementary:

Alternate No 1 – Hemlock Elementary Café Canopy

Add / Deduct \$ _____

Alternate No 2 – Hemlock Elementary Multi-Purpose Room
 Acoustical Treatment

Add / Deduct \$ _____

Alternate No 3 – KC Ling Softball Field

Add / Deduct \$ _____

Alternate No 4 – KC Ling Sinks

Add / Deduct \$ _____

Stadium Turf:

Unit Price No 1 – Supplemental Excavation, Satisfactory Soil Fill

Unit Price \$ _____

Cubic Yard \$ _____

Unit Price No 2 – Supplemental Excavation, Engineered Fill

Unit Price \$ _____

Cubic Yard \$ _____

Unit Price No 3 – Unforeseen replacement of existing slab on grade

Unit Price \$ _____

Cubic Yard \$ _____

SUBMITTALS

Anticipated Date of Shop Drawing Submittal at Post Bid Interview: _____

Anticipated Number of Days to Begin: _____

Anticipated Number of On-site Staff: _____

Anticipated Number of Days to Complete: _____

Anticipated Number of Days for Delivery of Needed Items: _____

Proposed Manufacturers, Suppliers, and/or Subcontractors:

<u>Item(s)</u>	<u>Manufacturer/Subcontractor/Supplier</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

VOLUNTARY ALTERNATES / VALUE ENGINEERING SUGGESTIONS

We suggest the following alternate procedure(s) and/or material(s):

<u>Summary of Suggestions</u>	<u>Deduct from Base Bid</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

BID DIVISION RESPONSIBILITY

We recognize that the Scope of Work within a Bid Division represents a construction segment that is not necessarily restricted to a single construction trade, and our Proposal includes work of all trades required to fully and successfully complete all of the Work required in the Bid Division(s) we have submitted Proposals for:

SCHEDULE

We have reviewed the Preliminary Milestone Schedule and hereby endorse it with regard to the Work of Bid Division(s) we have bid. ALL WORK MUST BE COMPLETED BY **August 20, 2023.**

EXCEPTIONS AND/OR SUBSTITUTIONS

We have submitted our Proposal, as specified, complete and in accordance with the Bidding Documents, including Addenda and the Contract Documents, without exceptions or substitutions, unless otherwise noted in the "Voluntary Alternate / Value Engineering Suggestions" portion of this Proposal Form.

EXECUTION

Name of Bidder: _____

Bidder's Status:
__ Corporation; __ Partnership; __ Sole Proprietor; __ Other: (Please Specify: _____)

By/Signature: _____

Name: _____

Title: _____

Date: _____

Email: _____

Phone: _____ Fax: _____

END OF SECTION 00305

Familial Relationship Sworn Statement

_____ does hereby disclose that per MCL 380.1267:
Company Name

YES, There exists a familial relationship between the Owner of the project or any member of their Board, or Board of Directors, or the Superintendent of the School district, intermediate superintendent of the intermediate school district, or chief executive officer of the public school academy and the Owner or an employee(s) of _____.
Company Name

Disclosure Between:

Name _____ AND Name _____

Title: _____ Title: _____

Relationship: _____ Relationship: _____

NO, There does not exist a familial relationship between the Owner of the project or any member of their Board, or Board of Directors, or the Superintendent of the School district, intermediate superintendent of the intermediate school district, or chief executive officer of the public school academy and the Owner or an employee(s) of _____.
Company Name

Name (printed): _____

Position: _____

Signature: _____

Date: _____

Notary Public(printed): _____

Signature: _____

County: _____

Date: _____ My Commission Expires: _____

Affix Notary Seal Here:



END OF SECTION 00306

Iran Business Relationship Affidavit

Effective April 1, 2013 all bids, proposals, and/or qualification statements received in the State of Michigan must comply with the "Iran Economic Sanctions Act". The following certification is to be signed and included at time of submittal.

CERTIFICATION

Pursuant to the Michigan Iran Economic Sanctions Act, 2012 P.A. 517, by submitting a bid, proposal or response, Respondent certifies, under civil penalty for false certification, that it is fully eligible to do so under law and that it is not an "Iran linked business," as that term is defined in the Act.

Signature

Title

Company

Date

IRAN ECONOMIC SANCTIONS ACT
Act 517 of 2012

AN ACT to prohibit persons who have certain economic relationships with Iran from submitting bids on requests for proposals with this state, political subdivisions of this state, and other public entities; to require bidders for certain public contracts to submit certification of eligibility with the bid; to require reports; and to provide for sanctions for false certification.

History: 2012, Act 517, Eff. Apr. 1, 2013.

The People of the State of Michigan enact:

129.311 Short title.

Sec. 1. This act shall be known and may be cited as the "Iran economic sanctions act".

History: 2012, Act 517, Eff. Apr. 1, 2013.

129.312 Definitions.

Sec. 2. As used in this act:

(a) "Energy sector of Iran" means activities to develop petroleum or natural gas resources or nuclear power in Iran.

(b) "Investment" means 1 or more of the following:

(i) A commitment or contribution of funds or property.

(ii) A loan or other extension of credit.

(iii) The entry into or renewal of a contract for goods or services.

(c) "Investment activity" means 1 or more of the following:

(i) A person who has an investment of \$20,000,000.00 or more in the energy sector of Iran.

(ii) A financial institution that extends \$20,000,000.00 or more in credit to another person, for 45 days or more, if that person will use the credit for investment in the energy sector of Iran.

(d) "Iran" means any agency or instrumentality of Iran.

(e) "Iran linked business" means either of the following:

(i) A person engaging in investment activities in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers or products used to construct or maintain pipelines used to transport oil or liquefied natural gas for the energy sector of Iran.

(ii) A financial institution that extends credit to another person, if that person will use the credit to engage in investment activities in the energy sector of Iran.

(f) "Person" means any of the following:

(i) An individual, corporation, company, limited liability company, business association, partnership, society, trust, or any other nongovernmental entity, organization, or group.

(ii) Any governmental entity or instrumentality of a government, including a multilateral development institution, as defined in section 1701(c)(3) of the international financial institutional act, 22 USC 262r(c)(3).

(iii) Any successor, subunit, parent company, or subsidiary of, or company under common ownership or control with, any entity described in subparagraph (i) or (ii).

(g) "Public entity" means this state or an agency or authority of this state, school district, community college district, intermediate school district, city, village, township, county, public authority, or public airport authority.

History: 2012, Act 517, Eff. Apr. 1, 2013.

129.313 Ineligibility of Iran linked business to submit request for proposal bid; certification.

Sec. 3. (1) Beginning April 1, 2013, an Iran linked business is not eligible to submit a bid on a request for proposal with a public entity.

(2) Beginning April 1, 2013, a public entity shall require a person that submits a bid on a request for proposal with the public entity to certify that it is not an Iran linked business.

History: 2012, Act 517, Eff. Apr. 1, 2013.

129.314 Effect of false certification.

Sec. 4. If a public entity determines, using credible information available to the public, that a person has submitted a false certification under section 3(2), the public entity shall provide the person with written notice of its determination and of the intent not to enter into or renew a contract with the person. The notice shall include information on how to contest the determination and specify that the person may become eligible for a

future contract with the public entity if the person ceases the activities that cause it to be an Iran linked business. The person shall have 90 days following receipt of the notice to respond in writing and to demonstrate that the determination of false certification was made in error. If a person does not make that demonstration within 90 days after receipt of the notice, the public entity may terminate any existing contract and shall report the name of the person to the attorney general together with information supporting the determination.

History: 2012, Act 517, Eff. Apr. 1, 2013.

129.315 Civil action; penalty.

Sec. 5. The attorney general may bring a civil action against any person reported under section 4. If a civil action results in a finding that the person submitted a false certification, the person is responsible for a civil penalty of not more than \$250,000.00 or 2 times the amount of the contract or proposed contract for which the false certification was made, whichever is greater, the cost of the public entity's investigation, and reasonable attorney fees, in addition to the fine. A person who submitted a false certification shall be ineligible to bid on a request for proposal for 3 years from the date the public entity determines that the person has submitted the false certification.

History: 2012, Act 517, Eff. Apr. 1, 2013.

129.316 Conditional effect.

Sec. 6. The provisions of this act are effective only if Iran is a state sponsor of terror as defined under section 2 of the divestment from terror act, 2008 PA 234, MCL 129.292.

History: 2012, Act 517, Eff. Apr. 1, 2013.

END OF SECTION 00307

Bid Division: 030100 – Concrete

Bid to Include:

Total Responsibility for Specification Sections:

Section 016000 – Product Requirements
Section 033000 – Cast In Place Concrete
Section 035416 – Hydraulic Cement Underlayment
Section 036000 – Post Installed Anchors
Section 321313 – Concrete Paving
Section 321373 – Concrete Paving Joint Sealants

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 330100 – Excavating (As it relates to fine grading, final compaction and backfill)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Sidewalks, curbs, floor slabs, grouting base plates, fine grading, foundations, footing excavation, and backfill, etc. Saw cutting of concrete and slab insulation.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.

Wolgast Corporation – Construction Management

Bid Division: 030100 – Concrete

12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Removal of excess spoils generated by this bid division from site.
2. Grout under steel column base plates.
3. Provide dewatering as needed for work in this Bid Division, if required.
4. No concrete is to be installed until acceptable density testing has been verified. Any concrete installed without density verification will become the sole responsibility of the Contractor and may be required to be replaced at the Contractor's expense.
5. Mechanical and electrical housekeeping pads.
6. Install all miscellaneous embedded items supplied by others (i.e. anchor bolts, bumper posts, inserts).
7. Coordination with electrician on installation of the under-floor raceway and boxes.
8. Finish grade of all sand or other fill cushion under interior and exterior slabs on grade, walks, pads, or aprons.
9. Provide temporary weather protection as needed, including temporary enclosures, temporary heat and temporary heating fuel, concrete additives and accelerators as required.
10. All exterior concrete. (Including, but not limited to sidewalks, curbs, trash corral pad, footings, chiller pad, etc.)
11. This contractor is responsible for compaction at footing bottoms.
12. Furnish and install foundation and under slab insulation.
13. Provide excavation and backfill of footings.
14. Patch all concrete floors as shown on Demolition drawings.
15. Provide all thickened slabs.
16. Excavate and backfill all interior footings.
17. All interior concrete slabs, walks and pads must be finished to a levelness tolerance of a maximum ¼" in ten (10') feet unless specifically stated other wise by the construction documents.
18. Contractor must provide written certification by an independent testing agency of all slabs, walk and pad level tolerances. Certification to be established using a five (5') foot grid.
19. Provide written acceptance of grade elevations to Construction Manager after Site Work contractor has established the building pad.

Project Inclusions:

1. Grout under steel column base plates, and set all leveling nuts to the proper elevation.
2. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources to achieve the milestone dates for this work.
3. Furnish and install all required exterior and interior concrete work.
4. Provide reinforcing steel shop drawings and mix designs with the first submittals.
5. Furnish and install all required vapor barriers, expansion joint materials and all interior and exterior joint sealants.

Bid Division: 030100 – Concrete

6. Furnish and install dowels at new to existing concrete slabs, sidewalks, curbs, etc. maximum spacing of 24" oc.
7. Furnish and install ADA detectable warning plates at ramped walks.
8. Coordinate with General Trades to place provided signs in concrete.
9. Saw cut track to allow for straight edge to place new curb.
10. Furnish and install wood nailer on turf field curb.
11. Contractor to coordinate with turf manufacturer and sitework contractor.
12. Must provide all submittals within 15 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Mandatory attendance at all required pre-installation meetings.
14. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.

Excludes:

1. Concrete Testing
2. Floor patching for mechanical and electrical trades, beyond what is required on the demolition drawings.
3. Demolition of exterior concrete surfaces by Bid Division 024200.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 030100

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

030100 Concrete

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
030100	Concrete	006	Product Data for Concrete Paving	32 1313
030100	Concrete	005	Quality Assurance submittals for Post Installed Anchors	03 6000
030100	Concrete	001	Product Data for Cast-in-Place Concrete	03 3000
030100	Concrete	003	Product Data for Hydraulic Cement Underlayment	03 5416
030100	Concrete	002	Design Mixture for Cast-in-Place Concrete	03 3000
030100	Concrete	004	Product Specifications for Post Installed Anchors	03 6000
030100	Concrete	008	Product Data for Concrete Paving Joint Sealants	321373
030100	Concrete	007	Design Mixture for Concrete Paving	32 1313
030100	Concrete	009	Product Test Reports for Concrete Paving Joint Sealants	321373
030100 - PA	Concrete - Startups	002	Schedule of Values	
030100 - PA	Concrete - Startups	003	Signed Contracts Returned	
030100 - PA	Concrete - Startups	004	Payment/Performance Bonds	
030100 - PA	Concrete - Startups	005	Letter of Compliance	
030100 - PA	Concrete - Startups	006	Certificate of Insurance	
030100 - PA	Concrete - Startups	007	Employee List	
030100 - PA	Concrete - Startups	008	Safety Policy	
030100 - PA	Concrete - Startups	009	SDS Sheets	
030100 - PA	Concrete - Startups	010	Sub/Supplier Certification Form	
030100 - PA	Concrete - Startups	001	Signed Post Bid Interview Form	
030100 - PA	Concrete - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
030100 - PACO	Concrete - Closeouts	014	Certificate of Substantial Completion	
030100 - PACO	Concrete - Closeouts	012	Contractor (2) Year Guarantee	
030100 - PACO	Concrete - Closeouts	015	Completed Punch List	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
030100 - PACO	Concrete - Closeouts	016	As Built Drawings	
030100 - PACO	Concrete - Closeouts	013	Consent of Surety	
030100 - PACO	Concrete - Closeouts	018	Current Certificate of Insurance	
030100 - PACO	Concrete - Closeouts	017	All processed Change Orders Returned	
030100 - PACO	Concrete - Closeouts	019	Signed Hazardous Materials	
030100 - PACO	Concrete - Closeouts	020	Asbestos Materials Affidavits	
030100 - PACO	Concrete - Closeouts	022	Operations & Maintenance Manuals	
030100 - PACO	Concrete - Closeouts	021	Warranties for Equipment Installed	
030100 - PACO	Concrete - Closeouts	024	Inspections & Certificates	
030100 - PACO	Concrete - Closeouts	023	Replacement Parts turned over to Owner	

Bid Division: 050000 – Metals

Bid to Include:

Total Responsibility for Specification Sections:

Section 016000 – Product Requirements
Section 051200 – Structural Steel Framing
Section 053100 – Steel Decking
Section 055000 – Metal Fabrications
Section 055213 – Pipe and Tube Railings

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 033000 – Cast In Place Concrete (Provide steel to be embedded in concrete)
Section 042000 – Unit Masonry (Provide steel to be embedded in masonry)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Welding, structural steel, stud joists, shoring, decking, etc., for complete operational system.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.

Bid Division: 050000 – Metals

11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
12. Provide all layout and measurements required to perform the work of this Bid Division.
13. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Furnish and install roof sump pans.
2. Supply all anchor bolts to installing contractors.
3. Provide all metal fabrications to be installed by Bid Division 030100/040000, including anchor bolts and imbeds.
4. Provide prime touch-up paint and cleaning of erected steel as required for proper finish painting of all steel.
5. Maintain cleanliness of steel until erected.
6. Clean any dirt or debris from steel in a condition ready to receive paint and acceptable by painting contractor.
7. Provide all steel angle or beam lintels for all required masonry penetrations over 24" wide in addition to any listed in lintel and beam schedules.
8. Provide all special inspections required per specifications.
9. This Contractor is responsible to follow all MIOSHA standards, including, but not limited to the Revised Part 26 of the MIOSHA standard, all fall protection, site-specific planning meetings, etc.
10. Provide all perimeter roof angles.
11. Provide and install all miscellaneous steel for roof curbs and roof draining and RTU.
12. Prime all weldings with primer.
13. Furnish & Install bridging, fasteners, and the accessories for a complete installation.
14. Furnish bearing plates, sleeves and guard posts for installation by others.

Project Inclusions:

1. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources to achieve the milestone schedule critical path.
2. Furnish and install all required structural and miscellaneous steel.
3. Furnish all required metal deck.
4. Furnish and install roof railing system. Provide shop drawings for this system.
5. Furnish and install all required new steel for roof drain and rooftop mechanical units. Obtain all sized and locations of steel frames from mechanical contractor for all roof openings.
6. Provide submittals within 15 days of owner contract award.
7. Mandatory attendance at pre-construction meeting.
8. Mandatory attendance at jobsite meetings with work related to this trade.
9. Completion of all punch list items 5 working days or less upon receipt of punch list.

Excludes:

1. Installation of imbedded steel (anchor bolts, lintels, etc.)

Wolgast Corporation – Construction Management

Bid Division: 050000 – Metals

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 050000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

050000 Metals

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
050000	Metals	010	Product Data for Structural Steel Framing	05 1200
050000	Metals	012	Delegated-Design Submittal for Structural Steel Framing	05 1200
050000	Metals	011	Shop Drawings for Structural Steel Framing	05 1200
050000	Metals	013	Product Data for Steel Decking	05 3100
050000	Metals	014	Shop Drawings for Steel Decking	05 3100
050000	Metals	015	Product Data for Metal Fabrications	05 5000
050000	Metals	016	Shop Drawings for Metal Fabrications	05 5000
050000	Metals	018	Product Data for Pipe and Tube Railings	05 5213
050000	Metals	020	Delegated-Design Submittal for Pipe and Tub Railings	05 5213
050000	Metals	017	Delegated-Design Submittal for Metal Fabrications	05 5000
050000	Metals	019	Shop Drawings for Pipe and Tube Railings	05 5213
050000 - PA	Metals - Startups	002	Schedule of Values	
050000 - PA	Metals - Startups	004	Payment/Performance Bonds	
050000 - PA	Metals - Startups	001	Signed Post Bid Interview Form	
050000 - PA	Metals - Startups	006	Certificate of Insurance	
050000 - PA	Metals - Startups	003	Signed Contracts Returned	
050000 - PA	Metals - Startups	008	Safety Policy	
050000 - PA	Metals - Startups	005	Letter of Compliance	
050000 - PA	Metals - Startups	009	SDS Sheets	
050000 - PA	Metals - Startups	010	Sub/Supplier Certification Form	
050000 - PA	Metals - Startups	007	Employee List	
050000 - PA	Metals - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
050000 - PACO	Metals - Closeouts	013	Consent of Surety	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
050000 - PACO	Metals - Closeouts	015	Completed Punch List	
050000 - PACO	Metals - Closeouts	018	Current Certificate of Insurance	
050000 - PACO	Metals - Closeouts	019	Signed Hazardous Materials	
050000 - PACO	Metals - Closeouts	012	Contractor (2) Year Guarantee	
050000 - PACO	Metals - Closeouts	020	Asbestos Materials Affidavits	
050000 - PACO	Metals - Closeouts	014	Certificate of Substantial Completion	
050000 - PACO	Metals - Closeouts	021	Warranties for Equipment Installed	
050000 - PACO	Metals - Closeouts	016	As Built Drawings	
050000 - PACO	Metals - Closeouts	022	Operations & Maintenance Manuals	
050000 - PACO	Metals - Closeouts	017	All processed Change Orders Returned	
050000 - PACO	Metals - Closeouts	023	Replacement Parts turned over to Owner	
050000 - PACO	Metals - Closeouts	024	Inspections & Certificates	

Bid Division: 060000 – General Trades

Bid to Include:

Total Responsibility for Specification Sections:

Section 012300 - Alternates
Section 016000 – Product Requirements
Section 024119 – Selective Demolition
Section 042000 – Unit Masonry
Section 061000 – Rough Carpentry
Section 064116 – Plastic Laminate Faced Architectural Cabinets
Section 066400 – Plastic Paneling
Section 074293 – Soffit Panels
Section 075323 – Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
Section 076200 – Sheet Metal Flashing and Trim
Section 077100 – Roof Specialties
Section 083323 – Overhead Coiling Doors
Section 101426 – Post and Panel Pylon Signage
Section 101453 – Traffic Signage
Section 123623.13 – Plastic-Laminate-Clad Countertops

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 078413 – Penetration Firestopping (As it relates to work in this Bid Division)
Section 078443 – Joint Firestopping (As it relates to work in this Bid Division)
Section 079200 – Joint Sealants (As it relates to work in this Bid Division)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

All required nailers, fasteners, blocking, etc for a complete operational system.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.

Bid Division: 060000 – General Trades

8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor's obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Unloading, protection and record of all hollow metal doors and frames.
2. All wood nailers for roof blocking, fascia, masonry, etc.
3. Wood blocking around windows and doors.
4. All temporary shoring as required for work in this Bid Division.
5. Provide, receive, store, protect, inventory, and install all described bid items.
6. Submittal of required product data and shop drawings within two (2) weeks of Construction Contract or Owner's Letter of Intent.
7. Provide for proper legal off-site disposal off all construction debris generated by the described work.
8. Sufficient numbers of shop drawings are to be provided to the affected contractors (i.e. mason, electrician, etc.)
9. Provide wood base for lockers, if required.
10. Remove items indicated: clean, service and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
11. Remove and legally dispose of items not indicated to be reinstalled, salvaged or to remain the Owner's property.
12. Install all doorframes, and coordinate with mason contractor.
13. Cover all countertops with double layered corrugated cardboard.
14. Clean and dust all casework upon completion.
15. Clean, prep and adjust all equipment immediately prior to Owner occupancy.
16. Patch walls after removal of existing tack strips and tack boards that are not covered by new strips or boards. Walls shall be brought to a surface ready to receive new paint.
17. Patch all demolished areas and items affected by demolition to a condition ready to receive finishes and finish materials.

Bid Division: 060000 – General Trades

18. Furnish and install all joint sealants and fire stopping as indicated in specifications and drawings including but not limited to perimeter joints of doors and louvers at interior and exterior, perimeter joints between interior wall surfaces and frames of interior doors and all other joints indicated.
19. Contractor shall broom sweep building daily.
20. Provide all temporary enclosures as required, review demo drawings throughout the duration of construction.
21. Contractor shall furnish and install temporary insulated weather-tight closures of openings created as a result of the work in this scope in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and for building security. Provide doors with self-closing hardware and locks.
22. Provide all wood framing, plywood and nailers as shown and specified.
23. Review alternates.
24. Provide all wood blocking in metal stud walls for all materials that will require it, including but not limited to, casework, fixtures, toilet accessories, coat racks, signage, curtains, marker & tack boards, etc.
25. The contractor shall engage an authorized factory service representative to perform a start-up service prior to the acceptance of the doors by the owner and construction manager. The start-up service certification shall include: verification of correct motor wiring and voltage; adjusting the door for proper operation; testing, adjusting and correcting the door controls and safeties; testing the door for proper function as required by the architect's specifications; the formal training of the owner and owner's representatives for the proper operation and maintenance of the door. The authorized factory service representative shall provide a written certification with the request for final payment stating that the start-up service has been performed and that each of the above items have been verified for proper operation.

Project Inclusions:

1. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources to achieve the milestone dates for this work.
2. Provide all selective building demolition work as indicated on the drawings
3. Furnish and install pole barn construction including all concrete foundations with all required excavation, backfill and compaction for this work.
4. Furnish and install all framing, trusses, roof sheathing, metal wall panels and all associated trim. Refer to drawings and details.
5. Furnish and install all roofing materials.
6. Install all steel bearing plates and lintels per drawings.
7. Tooth in all infills as required.
8. Steel and lintels provided by 050000.
9. Furnish and install aluminum soffit panels, fascia and associated trims.
10. Furnish and install the sectional overhead doors with all hardware for a complete installation.
11. Furnish and install hollow metal door frame, FRP door and all required door hardware for a complete, functional operation.
12. Must provide all submittals within 15 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Mandatory attendance at all required pre-installation meetings.
14. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.

Excludes:

1. All demolition of conduits, ducts, pipes, fixtures, etc. (demolition required for all mechanical, plumbing, and electrical work) is to be performed by the specific mechanical, plumbing and electrical contractors.
2. Hardware for aluminum entries
3. Aluminum frames
4. Dens-Glass is by bid division 091000.

Bid Division: 060000 – General Trades

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 060000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

060000 General Trades

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
060000	General Trades	022	Shop Drawings for Unit Masonry	04 2000
060000	General Trades	024	Product Data for Plastic-Laminate-Faced Architectural Cabinets	06 4116
060000	General Trades	025	Shop Drawings for Plastic-Laminated-Faced Architectural Cabinets	06 4116
060000	General Trades	026	Samples for Initial Selection for Plastic-Laminated Faced Architectural Cabinets	06 4116
060000	General Trades	027	Product Data for Plastic Paneling	06 6400
060000	General Trades	021	Product Data for Unit Masonry	04 2000
060000	General Trades	028	Samples for Plastic Paneling	06 6400
060000	General Trades	023	Product Data for Rough Carpentry	06 1000
060000	General Trades	030	Shop Drawings for Soffit Panels	07 4293
060000	General Trades	029	Product Data for Soffit Panels	07 4293
060000	General Trades	032	Product Data for Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	07 5323
060000	General Trades	031	Samples for Soffit Panels	07 4293
060000	General Trades	033	Shop Drawings for Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	07 5323
060000	General Trades	034	Wind Uplift Resistance for Ethylene-Propylene-Diene-Monomer (EPDM) Roofing	07 5323
060000	General Trades	035	Product Data for Sheet Metal Flashing and Trim	07 6200
060000	General Trades	036	Shop Drawings for Sheet Metal Flashing and Trim	07 6200
060000	General Trades	037	Samples for Sheet Metal Flashing and Trim	07 6200
060000	General Trades	039	Shop Drawings for Roof Specialties	07 7100
060000	General Trades	040	Samples for Initial Selection for Roof Specialties	07 7100
060000	General Trades	038	Product Data for Roof Specialties	07 7100
060000	General Trades	042	Product Data for Penetration Firestopping	07 8413
060000	General Trades	041	Samples for Verification for Roof Specialties	07 7100



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
060000	General Trades	044	Product Data for Joint Firestopping	07 8443
060000	General Trades	043	Product Schedule for Penetration Firestopping	07 8413
060000	General Trades	045	Product Schedule for Joint Firestopping	07 8443
060000	General Trades	047	Samples for Initial Selection for Joint Sealants	07 9200
060000	General Trades	046	Product Data for Joint Sealants	07 9200
060000	General Trades	048	Samples for Verification for Joint Sealants	07 9200
060000	General Trades	049	Product Data for Overhead Coiling Doors	08 3323
060000	General Trades	050	Shop Drawings for Overhead Coiling Doors	08 3323
060000	General Trades	051	Samples for Initial Selection for Overhead Coiling Doors	08 3323
060000	General Trades	052	Samples for Verification for Overhead Coiling Doors	08 3323
060000	General Trades	053	Product Data for Post and Panel Pylon Signage	10 1426
060000	General Trades	054	Shop Drawings for Post and Panel Pylon Signage	10 1426
060000	General Trades	055	Samples for Initial Verification for Post and Panel Pylon Signage	10 1426
060000	General Trades	057	Product Schedule for Post and Panel Pylon Signage	10 1426
060000	General Trades	056	Samples for Verification for Post and Panel Pylon Signage	10 1426
060000	General Trades	058	Product Data for Traffic Signage	10 1453
060000	General Trades	059	Product Data for Plastic-Laminate-Clad Countertops	12 3623.13
060000	General Trades	061	Samples for Plastic-Laminate-Clad Countertops	12 3623.13
060000	General Trades	060	Shop Drawings for Plastic-Laminate-Clad Countertops	12 3623.13
060000 - PA	General Trades - Startups	001	Signed Post Bid Interview Form	
060000 - PA	General Trades - Startups	003	Signed Contracts Returned	
060000 - PA	General Trades - Startups	002	Schedule of Values	
060000 - PA	General Trades - Startups	005	Letter of Compliance	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
060000 - PA	General Trades - Startups	004	Payment/Performance Bonds	
060000 - PA	General Trades - Startups	007	Employee List	
060000 - PA	General Trades - Startups	006	Certificate of Insurance	
060000 - PA	General Trades - Startups	009	SDS Sheets	
060000 - PA	General Trades - Startups	008	Safety Policy	
060000 - PA	General Trades - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
060000 - PA	General Trades - Startups	010	Sub/Supplier Certification Form	
060000 - PACO	General Trades - Closeouts	012	Contractor (2) Year Guarantee	
060000 - PACO	General Trades - Closeouts	013	Consent of Surety	
060000 - PACO	General Trades - Closeouts	015	Completed Punch List	
060000 - PACO	General Trades - Closeouts	017	All processed Change Orders Returned	
060000 - PACO	General Trades - Closeouts	014	Certificate of Substantial Completion	
060000 - PACO	General Trades - Closeouts	019	Signed Hazardous Materials	
060000 - PACO	General Trades - Closeouts	016	As Built Drawings	
060000 - PACO	General Trades - Closeouts	020	Asbestos Materials Affidavits	
060000 - PACO	General Trades - Closeouts	021	Warranties for Equipment Installed	
060000 - PACO	General Trades - Closeouts	018	Current Certificate of Insurance	
060000 - PACO	General Trades - Closeouts	023	Replacement Parts turned over to Owner	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
	Closeouts			
060000 - PACO	General Trades - Closeouts	022	Operations & Maintenance Manuals	
060000 - PACO	General Trades - Closeouts	025	Inventory of items that have been removed and salvaged for Selective Demo	02 4119
060000 - PACO	General Trades - Closeouts	026	Maintenance Data for Soffit Panels	07 4293
060000 - PACO	General Trades - Closeouts	024	Inspections & Certificates	
060000 - PACO	General Trades - Closeouts	028	Maintenance Data for Ethylene-Propylene-Diene-Monomer Roofing	07 5323
060000 - PACO	General Trades - Closeouts	027	Special Warranty on Panel Finishes for 20 Years from the Date of Substantial Completion for Soffit Panels	07 4293
060000 - PACO	General Trades - Closeouts	030	Manufacturer's 15 Year Warranty from Date for Substantial Completion for Ethylene-Propylene-Diene-Monomer Roofing	07 5323
060000 - PACO	General Trades - Closeouts	032	Manufacturer's 20 Year Warranty from Date of Substantial Completion to include Color Fading, Chalking and Cracking for Sheet Metal Flashing and Trim	07 6200
060000 - PACO	General Trades - Closeouts	029	Wind Speed Warranty for Ethylene-Propylene-Diene-Monomer Roofing	07 5323
060000 - PACO	General Trades - Closeouts	033	Maintenance Data for Roofing Specialties	07 7100
060000 - PACO	General Trades - Closeouts	031	Maintenance Data for Sheet Metal Flashing and Trim	07 6200
060000 - PACO	General Trades - Closeouts	035	Installers Certificates for Penetration Firestopping	07 8413
060000 - PACO	General Trades - Closeouts	036	Installers Certificates for Joint Firestopping	07 8443
060000 - PACO	General Trades - Closeouts	034	Manufacturer's 20 year Warranty from Date of Substantial Completion to include Fluoropolymer Finish for Color Fading, Chalking and Cracking for Roofing Specialties	07 7100
060000 - PACO	General Trades - Closeouts	037	Maintenance Data for Overhead Coiling Doors	08 3323
060000 - PACO	General Trades - Closeouts	038	Owner Training for Overhead Coiling Doors. Submit a copy of the Sign in Sheet for this training.	08 3323
060000 - PACO	General Trades - Closeouts	040	Manufacturer's Special 5 year Warranty from the Date of Substantial Completion for Post and Panel Pylon Signage	10 1426



Wolgast Corporation
Job #: A22913-01 Hemlock Schools - BP #1
200 Wilson St
Hemlock, Michigan 48626
9896425282

Package Number	Package Name	Number	Title	Spec Section Number
060000 - PACO	General Trades - Closeouts	039	Maintenance Data for Post and Panel Pylon Signage	10.1426

Bid Division: 091000 – Drywall, Insulation & Acoustical

Bid to Include:

Total Responsibility for Specification Sections:

Section 016000 – Product Requirements
Section 079219 – Acoustical Joint Sealants
Section 092216 – Non-Structural Metal Framing
Section 092900 – Gypsum Board
Section 095113 – Acoustical Panel Ceilings
Section 098433 – Sound Absorbing Wall Units

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 078413 – Penetration Firestopping (As it relates to this scope of work)
Section 079200 – Joint Sealants (Miscellaneous caulking, control joints, etc.)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

All required hangers, fasteners, nailers, etc.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.

Bid Division: 091000 – Drywall, Insulation & Acoustical

11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Divisions Inclusions:

1. All metal stud framing and drywall for bulkheads and light coves.
2. All building insulation except for that specifically defined in bid division 030100, 040000, and 075000.
3. Supply and install drywall and metal framing as design and specified.
4. Supply and install all gypsum board, studs and insulation as indicated.
5. Supply and install all bulkheads.
6. Coordination with mechanical and electrical trades on layout of ceiling grid.
7. Provide Owner with the amount specified of each type of ceiling tile, suspension system, and wall panels, upon completion.
8. Patch existing remodeled areas as required.
9. Supply and install fire rated gypsum board tight to roof deck as indicated.
10. Expansion and control joints as required by design or product manufacturer.
11. Prior to layout of ceilings, contractor to accept humidity and temperature levels in the building.
12. Provide all drywall and plaster on metal as well as wood as indicated.
13. The on-site foreman for this Bid Division must be able to communicate with all employees and the Construction Manager's staff.
14. Follow room finish schedule.
15. Provide all vapor barriers as required by design and product manufacturer.
16. Provide all nailers and underlayment.
17. Provide all trim as it relates to Acoustical Ceiling System.
18. Provide all fasteners.
19. Furnish and install all caulking required for the work of this Bid Division.
20. Replacement and/or repair of defective and/or misaligned material installed by this contractor.
21. To repair any adjacent material damaged in the execution of the above listed work.
22. Provide smooth transition from existing work to new work.
23. Install louvers and access panels furnished by each architectural, mechanical and electrical contractor in locations encased in this contractor's work.
24. Provide all caulking and sealants for plasterwork or drywall as required.
25. Provide all EIFS work per manufacturer recommendations.
26. All gypsum board walls, gypsum board wall systems, gypsum board ceilings and/or gypsum board ceiling systems must be constructed with expansion joints at a maximum spacing of 30'-0" on-center in both directions as manufactured by the gypsum board manufacturer regardless of the all other specification requirements.

Bid Division: 091000 – Drywall, Insulation & Acoustical

Project Inclusions:

1. Review the milestone schedules. This bid division's work will be required to be completed at multiple locations and concurrently for some of the work. Prepare your bid proposal accordingly to allow for sufficient manpower and resources.
2. Furnish and install all required light-gage metal framing material and drywall, glass mat sheathing, etc. at all walls, ceilings, bulkheads, parapets, etc.
3. Provide all metal framing, drywall and insulation at all walls, including to the roof deck at locations as documented.
4. Furnish and install all acoustical ceiling systems, including acoustical clouds, as documented.
5. Furnish and install all materials for the bulkheads as documented.
6. Furnish and install all sound transmission control materials.
7. Furnish and install all sound absorbing wall units.
8. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
9. Mandatory attendance at all required pre-installation meetings.
10. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.
11. **Provide required manpower along with required work hours (including weekends if required) to meet the indicated schedule. There will be no cost compensation to meet schedule, if this contractor is behind the published milestone schedule.**

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 091000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

091000 Drywall, Insulation & Acoustical

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
091000	Drywall, Insulation & Acoustical	063	Product Schedule for Penetration Firestopping	07 8413
091000	Drywall, Insulation & Acoustical	062	Product Data for Penetration Firestopping	07 8413
091000	Drywall, Insulation & Acoustical	064	Product Data for Joint Sealants	07 9200
091000	Drywall, Insulation & Acoustical	067	Product Data for Acoustical Joint Sealants	07 9219
091000	Drywall, Insulation & Acoustical	069	Product Data for Non-Structural Metal Framing	09 2216
091000	Drywall, Insulation & Acoustical	065	Samples for Initial Selection for Joint Sealants	07 9200
091000	Drywall, Insulation & Acoustical	066	Samples for Verification for Joint Sealants	07 9200
091000	Drywall, Insulation & Acoustical	070	Product Data for Gypsum Board	09 2900
091000	Drywall, Insulation & Acoustical	068	Acoustical-Joint-Sealant-Schedule for Acoustical Joint Sealants	07 9219
091000	Drywall, Insulation & Acoustical	072	Product Data for Sound-Absorbing Wall Units	09 8433
091000	Drywall, Insulation & Acoustical	071	Product Data for Acoustical Panel Ceilings	09 5113
091000	Drywall, Insulation & Acoustical	073	Shop Drawings for Sound-Absorbing Wall Units	09 8433
091000	Drywall, Insulation & Acoustical	074	Samples for Sound-Absorbing Wall Units	09 8433
091000 - PA	Drywall, Insulation & Acoustical - Startups	002	Schedule of Values	
091000 - PA	Drywall, Insulation & Acoustical -	001	Signed Post Bid Interview Form	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
	Startups			
091000 - PA	Drywall, Insulation & Acoustical - Startups	003	Signed Contracts Returned	
091000 - PA	Drywall, Insulation & Acoustical - Startups	004	Payment/Performance Bonds	
091000 - PA	Drywall, Insulation & Acoustical - Startups	006	Certificate of Insurance	
091000 - PA	Drywall, Insulation & Acoustical - Startups	005	Letter of Compliance	
091000 - PA	Drywall, Insulation & Acoustical - Startups	007	Employee List	
091000 - PA	Drywall, Insulation & Acoustical - Startups	008	Safety Policy	
091000 - PA	Drywall, Insulation & Acoustical - Startups	009	SDS Sheets	
091000 - PA	Drywall, Insulation & Acoustical - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
091000 - PA	Drywall, Insulation & Acoustical - Startups	010	Sub/Supplier Certification Form	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	013	Consent of Surety	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	015	Completed Punch List	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	017	All processed Change Orders Returned	
091000 -	Drywall, Insulation	018	Current Certificate of Insurance	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
PACO	& Acoustical - Closeouts			
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	019	Signed Hazardous Materials	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	020	Asbestos Materials Affidavits	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	021	Warranties for Equipment Installed	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	012	Contractor (2) Year Guarantee	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	022	Operations & Maintenance Manuals	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	023	Replacement Parts turned over to Owner	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	024	Inspections & Certificates	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	026	Installers Certificates for Joint Firestopping	07 8443
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	028	Extra Material: Acoustical Ceiling Units: Full-Size Panels equal to 2% of quantity installed, that match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Acoustical Panel Ceilings. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 5113
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	029	Extra Material: Hold-Down Clips: Full-Size Panels equal to 2% of quantity installed, that match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Acoustical Panel Ceilings. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 5113
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	030	Maintenance Data for Sound-Absorbing Wall Units	09 8433
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	014	Certificate of Substantial Completion	



Wolgast Corporation
Job #: A22913-01 Hemlock Schools - BP #1
200 Wilson St
Hemlock, Michigan 48626
9896425282

Package Number	Package Name	Number	Title	Spec Section Number
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	016	As Built Drawings	
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	025	Installers Certificates for Penetration Firestopping	07 84.13
091000 - PACO	Drywall, Insulation & Acoustical - Closeouts	027	Maintenance Data for Acoustical Panel Ceilings	09 5113

Bid Division: 096500 – Flooring

Bid to Include:

Total Responsibility for Specification Sections:

Section 096500 – Resilient Flooring
Section 096513 – Resilient Base and Accessories
Section 096566 – Resilient Athletic Flooring

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 079200 – Joint Sealants (As it relates to work in this Bid Division)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

All adhesives, base, sealants, etc.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.

Bid Division: 096500 – Flooring

15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Preparation of existing areas to receive new flooring, install as shown and specified. (Prep is this Bid Division's responsibility.)
2. Strip, clean and finish all floors immediately prior to the Owner's occupancy.
3. Transition strips from new VCT to existing or new ceramic and/or carpet, and/or terrazzo.
4. Expansion and control joints as required by design and/or product manufacturer.
5. Follow finish schedule.
6. Clean and prepare floor including leveling and filling of voids prior to starting work.
7. Provide all floor striping and graphics, if required.
8. Vacuum and spot clean carpet prior to Owner occupancy.
9. Provide and install all required base.
10. Transition and provider stripes.
11. Furnish and install all caulking required for the work of this Bid Division.
12. Provide Owner with additional flooring for each type, color, pattern and size installed. (Per specifications)
13. Replacement and/or repair of defective and/or misaligned material installed by this contractor.
14. To repair any adjacent material damaged in the execution of the above listed work.
15. All adhesives.
16. Provide and install thresholds as required.

Project Inclusions:

1. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources to achieve the milestone schedule critical path.
2. Clean and prepare floors to receive new flooring, including leveling and filling of voids prior to starting work, and in accordance with specifications and manufacturer's requirements. This contractor is responsible for furnishing and installing leveling materials to create a smooth finish flooring transition at dissimilar flooring materials or new to existing slabs.
3. Furnish and install all required transition strips and any other flooring trim materials
4. Must provide all submittals within 15 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
5. Mandatory attendance at all required pre-installation meetings.
6. Completion of all punch list work within 15 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.

Bid Division: 096500 – Flooring

Excludes:

1. Floor Demo by Bid Division 060000

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 096500

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

096500 Flooring

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
096500	Flooring	075	Product Data for Joint Sealants	07 9200
096500	Flooring	077	Samples for Verification for Joint Sealants	07 9200
096500	Flooring	076	Samples for Initial Selection for Joint Sealants	07 9200
096500	Flooring	079	Shop Drawings for Resilient Flooring	09 6500
096500	Flooring	078	Product Data for Resilient Flooring	09 6500
096500	Flooring	080	Samples for Verification for Resilient Flooring	09 6500
096500	Flooring	081	Welded-Seam Samples for Resilient Flooring	09 6500
096500	Flooring	082	Product Data for Resilient Base and Accessories	09 6513
096500	Flooring	083	Product Data for Resilient Athletic Flooring	09 6566
096500	Flooring	084	Shop Drawings for Resilient Athletic Flooring	09 6566
096500	Flooring	085	Samples for Initial Selection for Resilient Athletic Flooring	09 6566
096500	Flooring	086	Samples for Verification for Resilient Athletic Flooring	09 6566
096500 - PA	Flooring - Startups	001	Signed Post Bid Interview Form	
096500 - PA	Flooring - Startups	002	Schedule of Values	
096500 - PA	Flooring - Startups	003	Signed Contracts Returned	
096500 - PA	Flooring - Startups	004	Payment/Performance Bonds	
096500 - PA	Flooring - Startups	005	Letter of Compliance	
096500 - PA	Flooring - Startups	006	Certificate of Insurance	
096500 - PA	Flooring - Startups	008	Safety Policy	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
096500 - PA	Flooring - Startups	007	Employee List	
096500 - PA	Flooring - Startups	009	SDS Sheets	
096500 - PA	Flooring - Startups	010	Sub/Supplier Certification Form	
096500 - PA	Flooring - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
096500 - PACO	Flooring - Closeouts	012	Contractor (2) Year Guarantee	
096500 - PACO	Flooring - Closeouts	013	Consent of Surety	
096500 - PACO	Flooring - Closeouts	014	Certificate of Substantial Completion	
096500 - PACO	Flooring - Closeouts	015	Completed Punch List	
096500 - PACO	Flooring - Closeouts	016	As Built Drawings	
096500 - PACO	Flooring - Closeouts	017	All processed Change Orders Returned	
096500 - PACO	Flooring - Closeouts	018	Current Certificate of Insurance	
096500 - PACO	Flooring - Closeouts	019	Signed Hazardous Materials	
096500 - PACO	Flooring - Closeouts	020	Asbestos Materials Affidavits	
096500 - PACO	Flooring - Closeouts	021	Warranties for Equipment Installed	
096500 - PACO	Flooring - Closeouts	023	Replacement Parts turned over to Owner	
096500 - PACO	Flooring - Closeouts	022	Operations & Maintenance Manuals	
096500 - PACO	Flooring - Closeouts	025	Maintenance Data for Resilient Flooring	09 6500



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
096500 - PACO	Flooring - Closeouts	024	Inspections & Certificates	
096500 - PACO	Flooring - Closeouts	027	Extra Material: Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, for each type, color and pattern of flooring installed. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Resilient Flooring. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 6500
096500 - PACO	Flooring - Closeouts	026	Extra Material: Resilinet Sheet Flooring: Furnish not less than 10 LF for every 500 LF or fraction thereof, in a roll form and in full roll width for each type, color and pattern of flooring installed. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Resilient Flooring. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 6500
096500 - PACO	Flooring - Closeouts	029	Extra Material: Sheet Flooring: Furnish full-width rolls of not less than 10 LF for each 500 LF or fraction thereof, for each type, color and pattern of flooring installed. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Resilient Athletic Flooring. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 6566
096500 - PACO	Flooring - Closeouts	028	Extra Material: Furnish not less than 10 LF for every 500 LF or fraction thereof, for each type, color and pattern, and size of resilient product installed. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Resilient Base and Accessories. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 6513

Bid Division: 099000 – Painting

Bid to Include:

Total Responsibility for Specification Sections:

Section 016000 – Product Requirements
Section 099123 – Interior Painting
Section 099600 – High-Performance Coatings

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 079200 – Joint Sealants (Interior Control Joints and all dissimilar products)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

All painting of doors, frames, CMU walls, drywall, access panels, caulking and sealing of interior control joints, expansion joints and imperfections on finish surfaces.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.

Bid Division: 099000 – Painting

13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Finishing of wood casings and trim.
2. Follow room finish and door schedules.
3. Painting of all electrical and mechanical lines and equipment (as specified).
4. Paint all bulkheads.
5. Paint exposed structural components as specified.
6. Provide one (1) gallon of each color used (in unopened cans) to Owner at completion of Project.
7. Remove all foreign items and substances on existing surfaces (including, but not limited to, nails, hangers, tape, screws, etc.) and patch prior to painting.
8. All surfaces to be painted, including but not limited to drywall and masonry, are to be inspected and accepted by this contractor prior to application of paint. Surface imperfections not repaired prior to painting or submitted to the construction manager in writing as existing defects prior to painting, will be repaired by the painting contractor at no additional cost.
9. Painting Contractor is responsible for removing or protecting all cover plates, trim and other pre-finished surfaces necessary for the completion of this work scope. This Contractor is responsible for replacing anything removed upon completion of work.
10. Provide final cleaning of work prior to Owner occupancy.
11. Furnish and install all caulking required for the work of this Bid Division.
12. To repair any adjacent material damaged in the execution of the above listed work.
13. All caulking of interior control joints
14. All caulking of interior joints between any and all dissimilar surfaces including door and window frames, CMU & Drywall.
15. Clean, dust and dirt off bar joist, deck and ductwork prior to painting.

Project Inclusions:

1. Review and quote all applicable alternates.
2. Review the milestone schedules. This bid division's work will be required to be completed at multiple locations and concurrently for some of the work. Prepare your bid proposal accordingly to allow for sufficient manpower and resources.
3. All surfaces to be painted, including but not limited to drywall, steel and masonry are to be inspected and accepted by this contractor prior to application of paint. Surface imperfections not repaired prior to painting or submitted to the Construction Manager in writing as existing defects prior to painting, will be repaired by the painting contractor at no additional cost.
4. Paint all gas lines as documented.
5. Provide complete prep and painting of existing surfaces as documented.
6. Provide complete prep and painting of existing and new exposed steel materials as documented.
7. Prep and paint all exposed roof framing, duct work, conduits and any other materials as documented.

Wolgast Corporation – Construction Management

Bid Division: 099000 – Painting

8. Paint all exposed drywall and CMU as documented.
9. Paint all hollow metal frames.
10. Provide all caulking of interior control joints in masonry, drywall, and drywall to dissimilar materials and inside masonry corners.
11. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
12. Mandatory attendance at all required pre-installation meetings.
13. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.
14. **Provide required manpower along with required work hours (including weekends if required) to meet the indicated schedule. There will be no cost compensation to meet schedule, if this contractor is behind the published milestone schedule.**

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 099000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

099000 Painting

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
099000	Painting	087	Product Data for Joint Sealants	07 9200
099000	Painting	089	Samples for Verification for Joint Sealants	07 9200
099000	Painting	091	Sample for Verification for Interior Painting	09 9123
099000	Painting	093	Product Data for High-Performance Coatings	09 9600
099000	Painting	095	Samples for Verification for High-Performance Coatings	09 9600
099000	Painting	096	Product List for High-Performance Coatings	09 9600
099000	Painting	088	Samples for Initial Selection for Joint Sealants	07 9200
099000	Painting	090	Product Data for Interior Painting	09 9123
099000	Painting	092	Product List for Interior Painting	09 9123
099000	Painting	094	Samples for initial Selection for High-Performance Coatings	09 9600
099000 - PA	Painting - Startups	001	Signed Post Bid Interview Form	
099000 - PA	Painting - Startups	002	Schedule of Values	
099000 - PA	Painting - Startups	004	Payment/Performance Bonds	
099000 - PA	Painting - Startups	003	Signed Contracts Returned	
099000 - PA	Painting - Startups	006	Certificate of Insurance	
099000 - PA	Painting - Startups	005	Letter of Compliance	
099000 - PA	Painting - Startups	008	Safety Policy	
099000 - PA	Painting - Startups	007	Employee List	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
099000 - PA	Painting - Startups	010	Sub/Supplier Certification Form	
099000 - PA	Painting - Startups	009	SDS Sheets	
099000 - PA	Painting - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
099000 - PACO	Painting - Closeouts	012	Contractor (2) Year Guarantee	
099000 - PACO	Painting - Closeouts	013	Consent of Surety	
099000 - PACO	Painting - Closeouts	014	Certificate of Substantial Completion	
099000 - PACO	Painting - Closeouts	015	Completed Punch List	
099000 - PACO	Painting - Closeouts	016	As Built Drawings	
099000 - PACO	Painting - Closeouts	017	All processed Change Orders Returned	
099000 - PACO	Painting - Closeouts	018	Current Certificate of Insurance	
099000 - PACO	Painting - Closeouts	019	Signed Hazardous Materials	
099000 - PACO	Painting - Closeouts	020	Asbestos Materials Affidavits	
099000 - PACO	Painting - Closeouts	021	Warranties for Equipment Installed	
099000 - PACO	Painting - Closeouts	022	Operations & Maintenance Manuals	
099000 - PACO	Painting - Closeouts	023	Replacement Parts turned over to Owner	
099000 - PACO	Painting - Closeouts	024	Inspections & Certificates	
099000 - PACO	Painting - Closeouts	025	Extra Material: Paint: 5%, but not less than 1 gallon of each material and color applied. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for Interior Painting. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 9123



Wolgast Corporation
Job #: A22913-01 Hemlock Schools - BP #1
200 Wilson St
Hemlock, Michigan 48626
9896425282

Package Number	Package Name	Number	Title	Spec Section Number
099000 - PACO	Painting - Closeouts	026	Extra Material: Coatings: 5%, but not less than 1 gallon of each material and color applied. That match products installed and that are packaged with Protective Covering for storage and identified with labels describing contents for High-Performance Coatings. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	09 9600

Bid Division: 222300 – Plumbing & HVAC Systems

Bid to Include:

Total Responsibility for Specification Sections:

Section 016000 – Product Requirements
Section 220500 – Common Work Results for Plumbing
Section 220513 – Common Motor Requirements for Plumbing Equipment
Section 220519 – Meters and Gages for Plumbing Piping
Section 220523 – General Duty Valves for Plumbing Piping
Section 220529 – Hangers and Supports for Plumbing Piping and Equipment
Section 220553 – Identification for Plumbing Piping and Equipment
Section 220700 – Plumbing Insulation
Section 221116 – Domestic Water Piping
Section 221119 – Domestic Water Piping Specialties
Section 221123 – Domestic-Water Pumps
Section 221313 – Facility Sanitary Sewers
Section 223450 – Domestic-Water Heaters
Section 224000 – Plumbing Fixtures
Section 230500 – Common Work Results for HVAC
Section 230513 – Common Motor Requirements for HVAC Equipment
Section 230519 – Meters and gages for HVAC Piping
Section 230523 – General Duty Valves for HVAC Piping
Section 230529 – Hangers and Supports for HVAC piping and Equipment
Section 230553 – Identification for HVAC Piping and Equipment
Section 230593 – Testing, Adjusting and Balancing for HVAC
Section 230700 – HVAC Insulation
Section 230900 – Instrumentation and Control for HVAC
Section 231123 – Facility Natural Gas Piping
Section 232113 – Hydronic Piping
Section 232123 – Hydronic Pumps
Section 232500 – HVAC Water Treatment
Section 233113 – Metal Ducts
Section 233300 – Air Duct Accessories
Section 233723 – HVAC Gravity Ventilators
Section 238223 – Unit Ventilators
Section 328420 – Water Distribution System

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 024119 – Selective Demolition (As it relates to work in this Bid Division)
Section 078413 – Penetration Firestopping
Section 079200 – Joint Sealants

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Plumbing, heating, ventilating, air conditioning, balancing, temperature control, etc., for a complete operational system.

Wolgast Corporation – Construction Management

Bid Division: 222300 – Plumbing & HVAC Systems

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Built, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor’s responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Concrete Patching for mechanical and electrical trades by Bid Division 15000 and 16000
2. Selective Demolition (concrete floors, etc.).
3. No concrete is to be installed until verification of acceptable density testing. Any concrete installed without density verification will become the sole responsibility of the Contractor and may be required to be replaced at the Contractor’s expense.
4. Provide all blocking required for plumbing fixture mounting.

Bid Division: 222300 – Plumbing & HVAC Systems

5. Perform all connections between site utilities and building, coordinate with site contractor on utilities.
6. Patch floors with concrete, where existing fixtures and pipe are removed and capped.
7. Removal of all plumbing and heating fixtures.
8. Provide proper repair of all ceilings, walls, floors, etc., when installing new piping fixtures and hangers.
9. Furnish and install all fixtures in cabinetry as required.
10. Provide all final connections and hook-ups for kitchen equipment.
11. Furnish all louvers and access panels to masonry and drywall contractors for installation.
12. Provide shop drawings to State Fire Marshall for Plan Review (allowing sufficient time for changes that may be made and must be completed prior to beneficial occupancy).
13. Patch all demolished areas and items affected by HVAC & plumbing demolition to a condition ready to receive finishes and finish materials (finish materials by others, i.e. carpet, tile paint, etc.).
14. Perform all excavating, backfill, and compaction required for the work of this bid division.
15. Furnish and install duct detectors, back draft dampers, etc. as shown and specified, and/or required by Code.
16. Perform all demolition necessary for the completion of the work of this Bid Division as shown and specified.
17. Provide all final plumbing hook-ups to all plumbing related fixtures and equipment.
18. Provide coordination with roofing and metal contractors for roof penetrations, equipment rails and pipe boots including layouts.
19. Maintain fire rating in all walls penetrated.
20. Remove spoils from site.
21. Provide all required layout and verify that no conflict occurs with other trades.
22. Furnish operating and maintenance manuals.
23. Provide record and as-built drawings.
24. Provide all necessary connection between temperature control and instrumentation devices and equipment to be controlled.
25. Provide roof curbs for rooftop equipment.
26. Provide all permits required.
27. Provide all required work to prepare each piece of equipment to receive and allow for proper installation and operation of the temperature control modules and related automatic temperature control devices.
28. Provide temporary water distribution as required.
29. Provide all State Certification for equipment (boilers, etc.).
30. Refer to all equipment schedules for additional equipment to be furnished and installed (including kitchen equipment and kitchen equipment schedules).
31. Abandoning of retired plumbing.
32. Furnish test and balance reports.
33. Contractor shall coordinate phased delivery of all pre-purchased equipment with supplier.
34. Contractor shall maintain existing HVAC systems in fully functional order in occupied areas of the building throughout the duration of the project.
35. Contractor shall furnish and install temporary insulated weather-tight closures of openings created as a result of the work in this scope in exterior surfaces to provide acceptable working conditions and protection for materials, to allow temporary heating, and building security.
36. Remove, clean and reinstall all existing grids, vents, registers and diffusers including those mounted in metal ceiling grid systems.
37. All HVAC equipment is to be completed with all motor starters, disconnects or other items to allow for the proper operation of the system.
38. Disconnect all roof top units to allow roofing contractor to raise and replace flashings as required.
39. Provide start-up training with Owner Representative, Architect and Construction Manager for all equipment installed.
40. Final installation and all work by this bid division must comply with governing building and life safety codes.
41. Provide water test approval two weeks prior to Owner Occupancy.

Bid Division: 222300 – Plumbing & HVAC Systems

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 222300

Wolgast Corporation – Construction Management



Wolgast Corporation
Job #: A22913-01 Hemlock Schools - BP #1
200 Wilson St
Hemlock, Michigan 48626
9896425282

Hemlock - Bid Package #1

222300 Plumbing & HVAC Systems

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
222300	Plumbing & HVAC Systems	097	Product Data for Penetration Firestopping	07 8413
222300	Plumbing & HVAC Systems	098	Product Schedule for Penetration Firestopping	07 8413
222300	Plumbing & HVAC Systems	099	Product Data for Joint Sealants	07 9200
222300	Plumbing & HVAC Systems	100	Samples for Initial Selection for Joint Sealants	07 9200
222300	Plumbing & HVAC Systems	101	Samples for Verification for Joint Sealants	07 9200
222300	Plumbing & HVAC Systems	102	Product Data for Common Work Results for Plumbing	22 0500
222300	Plumbing & HVAC Systems	103	Product Data for Meters and Gages for Plumbing Piping	22 0519
222300	Plumbing & HVAC Systems	104	Product Data for General Duty Valves for Plumbing Piping	22 0523
222300	Plumbing & HVAC Systems	105	Valve Schedule for Identification for Plumbing Piping and Equipment	22 0553
222300	Plumbing & HVAC Systems	106	Product Data for Plumbing Insulation	22 0700
222300	Plumbing & HVAC Systems	107	Product Data for Domestic Water Piping Specialties	22 1119
222300	Plumbing & HVAC Systems	109	Shop Drawings for Facility Sanitary Sewers	22 1313



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
	HVAC Systems			
222300	Plumbing & HVAC Systems	110	Product Data for Domestic Water Heaters	22 3450
222300	Plumbing & HVAC Systems	111	Shop Drawings for Domestic Water Heaters	22 3450
222300	Plumbing & HVAC Systems	112	Product Data for Plumbing Fixtures	22 4000
222300	Plumbing & HVAC Systems	113	Product Data for Common Work Results for HVAC	23 0500
222300	Plumbing & HVAC Systems	108	Product Data for Domestic Water Pumps	22 1123
222300	Plumbing & HVAC Systems	117	Product Data for General Duty Valves for HVAC Piping	23 0523
222300	Plumbing & HVAC Systems	119	Shop Drawings for Hangers and Supports for HVAC Piping and Equipment	23 0529
222300	Plumbing & HVAC Systems	120	Product Data for Identification for HVAC Piping and Equipment	23 0553
222300	Plumbing & HVAC Systems	121	Samples for Identification for HVAC Piping and Equipment	23 0553
222300	Plumbing & HVAC Systems	114	Product Data for Common Motor Requirements for HVAC Equipment	23 0513
222300	Plumbing & HVAC Systems	115	Product Data for Meters and Gages for HVAC Piping	23 0519
222300	Plumbing & HVAC Systems	122	Equipment Label Schedule for Identification for HVAC Piping and Equipment	23 0553



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
222300	Plumbing & HVAC Systems	116	Wiring Diagrams for Meters and Gages for HVAC Piping	23 0519
222300	Plumbing & HVAC Systems	123	Valve Numbering Scheme for Identification for HVAC Piping and Equipment	23 0553
222300	Plumbing & HVAC Systems	118	Product Data for Hangers and Supports for HVAC Piping and Equipment	23 0529
222300	Plumbing & HVAC Systems	124	Valve Schedule for Identification for HVAC Piping and Equipment	23 0553
222300	Plumbing & HVAC Systems	126	Product Data for Instrumentation and Control for HVAC	23 0900
222300	Plumbing & HVAC Systems	125	Product Data for HVAC Insulation	23 0700
222300	Plumbing & HVAC Systems	127	Product Data for Facility Natural Gas Piping	23 1123
222300	Plumbing & HVAC Systems	129	Product Data for Hydronic Pumps	23 2123
222300	Plumbing & HVAC Systems	128	Product Data for Hydronic Piping	23 2113
222300	Plumbing & HVAC Systems	130	Shop Drawings for Hydronic Pumps	23 2123
222300	Plumbing & HVAC Systems	131	Product Data for Metal Ducts	23 3113
222300	Plumbing & HVAC Systems	133	Product Data for HVAC Gravity Ventilators	23 3723
222300	Plumbing & HVAC Systems	132	Product Data for Air Duct Accessories	23 3300



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
222300	Plumbing & HVAC Systems	134	Product Data for Unit Ventilators	23 8223
222300	Plumbing & HVAC Systems	135	Shop Drawings for Unit Ventilators	23 8223
222300	Plumbing & HVAC Systems	137	Product Data for Water Distribution System	328420
222300	Plumbing & HVAC Systems	136	Samples for Initial Selection for Unit Ventilators	23 8223
222300 - PA	Plumbing & HVAC Systems - Startups	002	Schedule of Values	
222300 - PA	Plumbing & HVAC Systems - Startups	001	Signed Post Bid Interview Form	
222300 - PA	Plumbing & HVAC Systems - Startups	004	Payment/Performance Bonds	
222300 - PA	Plumbing & HVAC Systems - Startups	003	Signed Contracts Returned	
222300 - PA	Plumbing & HVAC Systems - Startups	006	Certificate of Insurance	
222300 - PA	Plumbing & HVAC Systems - Startups	005	Letter of Compliance	
222300 - PA	Plumbing & HVAC Systems - Startups	007	Employee List	
222300 - PA	Plumbing & HVAC Systems - Startups	008	Safety Policy	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
PA	HVAC Systems - Startups			
222300 - PA	Plumbing & HVAC Systems - Startups	009	SDS Sheets	
222300 - PA	Plumbing & HVAC Systems - Startups	010	Sub/Supplier Certification Form	
222300 - PA	Plumbing & HVAC Systems - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
222300 - PA	Plumbing & HVAC Systems - Startups	012	Submit a copy of the Mechanical Permit	
222300 - PA	Plumbing & HVAC Systems - Startups	013	Submit a copy of the Plumbing Permit	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	014	Contractor (2) Year Guarantee	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	015	Consent of Surety	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	016	Certificate of Substantial Completion	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	017	Completed Punch List	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	018	As Built Drawings	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
	Closeouts			
222300 - PACO	Plumbing & HVAC Systems - Closeouts	019	All processed Change Orders Returned	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	021	Signed Hazardous Materials	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	020	Current Certificate of Insurance	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	022	Asbestos Materials Affidavits	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	024	Operations & Maintenance Manuals	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	023	Warranties for Equipment Installed	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	026	Inspections & Certificates	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	029	Inventory of items that have been removed and salvaged for Selective Demo	02 4119
222300 - PACO	Plumbing & HVAC Systems - Closeouts	025	Replacement Parts turned over to Owner	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	030	Installers Certificates for Penetration Firestopping	07 8413



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
222300 - PACO	Plumbing & HVAC Systems - Closeouts	027	Submit a Copy of the Certificate of Acceptance for the Mechanical Permit	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	028	Submit a Copy of the Certificate of Acceptance for the Plumbing Permit	
222300 - PACO	Plumbing & HVAC Systems - Closeouts	031	Operation & Maintenance Data for Meters and Gages for Plumbing Piping	22 0519
222300 - PACO	Plumbing & HVAC Systems - Closeouts	033	Backflow Preventor Assembly Test Report for Domestic Water Piping Specialties	22 1119
222300 - PACO	Plumbing & HVAC Systems - Closeouts	032	Operation & Maintenance Data for Domestic Water Piping Specialties	22 1119
222300 - PACO	Plumbing & HVAC Systems - Closeouts	035	Project Record Documents for Facility Sanitary Sewers	22 1313
222300 - PACO	Plumbing & HVAC Systems - Closeouts	034	Operation & Maintenance Data for Domestic Water Pumps	22 1123
222300 - PACO	Plumbing & HVAC Systems - Closeouts	037	Manufacturer's Special 3 year Warranty From Date of Substantial Completion for Water Heaters, for Domestic Water Heaters.	22 3450
222300 - PACO	Plumbing & HVAC Systems - Closeouts	036	Operation & Maintenance Data for Domestic Water Heaters	22 3450
222300 - PACO	Plumbing & HVAC Systems - Closeouts	038	Operation & Maintenance Data for Plumbing Fixtures	22 4000
222300 - PACO	Plumbing & HVAC	039	Owner Training for Plumbing Fixtures. Submit a copy of the Sign in Sheet for this training.	22 4000



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
	Systems - Closeouts			
222300 - PACO	Plumbing & HVAC Systems - Closeouts	040	Operation & Maintenance Data for Common Motor Requirements for HVAC Equipment	23 0513
222300 - PACO	Plumbing & HVAC Systems - Closeouts	041	Operation & Maintenance Data for Meters and Gages for HVAC Piping	23 0519
222300 - PACO	Plumbing & HVAC Systems - Closeouts	043	Owner Training for Instrumentation and Control for HVAC. Submit a copy of the Sign in Sheet for this training.	23 0900
222300 - PACO	Plumbing & HVAC Systems - Closeouts	042	Maintenance Data for Instrumentation and Control for HVAC	23 0900
222300 - PACO	Plumbing & HVAC Systems - Closeouts	045	Operation & Maintenance Data for Hydronic Piping	23 2113
222300 - PACO	Plumbing & HVAC Systems - Closeouts	044	Operation & Maintenance Data for Facility Natural Gas Piping	23 1123
222300 - PACO	Plumbing & HVAC Systems - Closeouts	047	Alignment Certificate for Hydronic Pumps	23 2123
222300 - PACO	Plumbing & HVAC Systems - Closeouts	046	Extra Material: Differential Pressure Meter. For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case for Hydronic Piping. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	23 2113
222300 - PACO	Plumbing & HVAC Systems - Closeouts	049	Owner Training for Hydronic Pumps. Submit a copy of the Sign in Sheet for this training.	23 2123
222300 - PACO	Plumbing & HVAC Systems - Closeouts	048	Operation & Maintenance Data for Hydronic Pumps	23 2123



Package Number	Package Name	Number	Title	Spec Section Number
222300 - PACO	Plumbing & HVAC Systems - Closeouts	050	Extra Material: Scope of Maintenance Service: provide Chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of 1 year from Date of Substantial Completion as specified in Spec Book for HVAC Water Treatment. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	23 2500
222300 - PACO	Plumbing & HVAC Systems - Closeouts	051	Owner Training for HVAC Water Treatment. Submit a copy of the Sign in Sheet for this training.	23 2500
222300 - PACO	Plumbing & HVAC Systems - Closeouts	053	Operation & Maintenance Data for Air Duct Accessories	23 3300
222300 - PACO	Plumbing & HVAC Systems - Closeouts	055	Owner Training for Unit Ventilators. Submit a copy of the Sign in Sheet for this training.	23 8223
222300 - PACO	Plumbing & HVAC Systems - Closeouts	057	Manufacturer's 2 year Warranty for Water Distribution System.	328420
222300 - PACO	Plumbing & HVAC Systems - Closeouts	052	Duct Leakage Reports for Metal Ducts	23 3113
222300 - PACO	Plumbing & HVAC Systems - Closeouts	054	Operation & Maintenance Data for Unit Ventilators	23 8223
222300 - PACO	Plumbing & HVAC Systems - Closeouts	056	Extra Material: 2 Brass Quick Coupler Keys with swivels to Owner to match system installed. System installed shall allow Owner to attach garden hose or water cannon to quick coupler key for Water Distribution System. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	328420

Bid Division: 260000 – Electrical

Bid to Include:

Total Responsibility for Specification Sections:

Section 012300 – Alternates
Section 014000 – Quality Requirements
Section 016000 – Product Requirements
Section 260500 – Common Work Results for Electrical
Section 260519 – Low-Voltage Electrical Power Conductors and Cables
Section 260526 – Grounding and Bonding for Electrical Systems
Section 260529 – Hangers and Supports for Electrical Systems
Section 260533 – Raceway and Boxes for Electrical Systems
Section 260543 – Underground Ducts and Raceways for Electrical Systems
Section 260544 – Sleeves and Sleeve Seals for Electrical Raceways for Electrical Systems
Section 260553 – Identification for Electrical Systems
Section 260800 – Minimum Commissioning of Electrical Systems
Section 260923 – Lighting Control Devices
Section 260943 – Lighting Control Systems
Section 262726 – Wiring Devices
Section 265100 – Interior Lighting
Section 265600 – Exterior Lighting

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 024119 – Selective Demolition (As it relates to work in this Bid Division)
Section 033000 – Cast In Place Concrete (Provide concrete for cut and patch areas; light pole bases)
Section 078413 – Penetration Firestopping
Section 079200 – Joint Sealants

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

All conduit, boxes, switches, etc., for a complete operational system.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
- 7.

Wolgast Corporation – Construction Management

Bid Division: 260000 – Electrical

8. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
9. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
10. Any contractor who compounds a mistake by installing their product on another Contractor's obvious faulty work will assume responsibility for repair of said work.
11. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
12. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
13. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
14. Provide all layout and measurements required to perform the work of this Bid Division.
15. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
16. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
17. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
18. Contractor shall have a supervisor on site at all times when a crew is present on the job.
19. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
20. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Contractor shall maintain existing electrical systems in fully functional order in all areas of the building during the duration of the project.
2. Contractor shall coordinate with utility company for purchase and installation of exterior transformers and associated work, if required.
3. Contractor shall coordinate with concrete contractor for locations of housekeeping pads and transformer pads. Concrete is by concrete contractor, layout and coordination is by electrical contractor.
4. Contractor shall furnish and install temporary insulated weather-tight closures of openings created as a result of the work in this scope in exterior surfaces to provide acceptable working conditions and protection for materials, to allow temporary heating, and building security.
5. Contractor is responsible for disconnecting, removing and legal and proper off site disposal of all indicated existing light fixtures including ballasts and bulbs. Ballasts shall be assumed to contain PCB's. Provide Owner with appropriate documentation of disposal.
6. Remove, clean and reinstall light fixtures where indicated.
7. Removal of electrical line power pole to old portable location.
8. Concrete Patching for mechanical and electrical trades by Bid Division 222300 and 260000.
9. Selective Demolition.
10. No concrete is to be installed until verification of acceptable density testing. Any concrete installed without density verification will become the sole responsibility of the Contractor and may be required to be replaced at the Contractor's expense.

Bid Division: 260000 – Electrical

11. Provide hook-up, final connection and interlocks for kitchen exhaust fan and kitchen make-up air units to hood controls.
12. Provide all permits required.
13. Supply and install exterior lights. (Including parking lot light bases.)
14. Remove spoils from site.
15. Provide all means necessary to provide temporary transformers to keep the school in operation before the final power turnover is complete.
16. Provide all cutting and patching required for existing tie-ins.
17. Maintain fire rating at all walls penetrated.
18. All excavation, backfill, compaction, and disposal of spoil for any electrical work placed below finish grade.
19. Coordinate with other trades for rough-in locations.
20. Provide temporary lighting and power distribution. A minimum of 100 watts of temporary lighting per 250 SF of floor area.
21. Provide all plywood or nailers required for mounting of electrical, audio, fire alarm or phone equipment.
22. Furnish any access hatches to mason and drywall contractors for installation required for electrical work.
23. Final hook-up of all equipment for other disciplines of work.
24. Patch all demolished areas affected by the electrical demolition to a condition ready to receive finish materials (finish materials by others, i.e. tile, carpet, etc.).
25. Perform all required demolition required for this trade as shown and specified.
26. Furnish and install all light and power fixtures in cabinetry.
27. Provide all final connection for kitchen equipment.
28. Supply and install a complete & operational fire protection alarm system.
29. Contractor is responsible for complete code compliance of Fire Alarm System.
30. Provide "As Built" Drawings for work.
31. Provide shop drawings to State Fire Marshal Plan Review or governing authority (allowing sufficient time for changes that may be made and must be completed prior to beneficial occupancy.)
32. Provide proper repair of all damaged ceilings, walls, floors, etc., when installing new fixtures.
33. Install pull box and chase conduit for temp control.
34. Provide Owner with training of new equipment.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 260000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

260000 Electrical

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
260000	Electrical	139	Product Schedule for Penetration Firestopping	07 8413
260000	Electrical	138	Product Data for Penetration Firestopping	07 8413
260000	Electrical	141	Samples for Initial Selection for Joint Sealants	07 9200
260000	Electrical	140	Product Data for Joint Sealants	07 9200
260000	Electrical	142	Samples for Verification for Joint Sealants	07 9200
260000	Electrical	143	Product Data for Grounding and Bonding for Electrical Systems	26 0526
260000	Electrical	145	Lead Submittals for Raceways and Boxes for Electrical Systems	26 0533
260000	Electrical	144	Product Data for Raceways and Boxes for Electrical Systems	26 0533
260000	Electrical	147	Product Data for Underground Ducts and Raceways for Electrical Systems	26 0543
260000	Electrical	146	Shop Drawings for Raceways and Boxes for Electrical Systems	26 0533
260000	Electrical	149	Shop Drawings for Factory Fabricated Handholes and Boxes for Underground Ducts and Raceways for Electrical Systems	26 0543
260000	Electrical	148	Shop Drawings for Precast or Factory Fabricated Underground Utility Structures for Underground Ducts and Raceways for Electrical Systems	26 0543
260000	Electrical	151	Lead Submittals for Sleeves and Sleeve Seals for Electrical Raceways and Cabling	26 0544
260000	Electrical	150	Product Data for Sleeves and Sleeve Seals for Electrical Raceways and Cabling	26 0544
260000	Electrical	153	Product Data for Lighting Control Devices	26 0923
260000	Electrical	152	Product Data for Identification for Electrical Systems	26 0553
260000	Electrical	154	Product Data for Lighting Control System	26 0943
260000	Electrical	155	Shop Drawings for Lighting Control System	26 0943
260000	Electrical	156	Product Data for Wiring Devices	26 2726
260000	Electrical	157	Shop Drawings for Wiring Devices	26 2726
260000	Electrical	158	Sample Finishes for Wiring Devices	26 2726
260000	Electrical	159	Product Data for Interior Lighting	26 5100



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
260000	Electrical	161	Shop Drawings for Interior Lighting	26 5100
260000	Electrical	160	Light Fixture Submittal for Interior Lighting	26 5100
260000	Electrical	162	Product Data for Exterior Lighting	26 5600
260000	Electrical	163	Shop Drawings for Exterior Lighting	26 5600
260000 - PA	Electrical - Startups	002	Schedule of Values	
260000 - PA	Electrical - Startups	003	Signed Contracts Returned	
260000 - PA	Electrical - Startups	004	Payment/Performance Bonds	
260000 - PA	Electrical - Startups	001	Signed Post Bid Interview Form	
260000 - PA	Electrical - Startups	005	Letter of Compliance	
260000 - PA	Electrical - Startups	006	Certificate of Insurance	
260000 - PA	Electrical - Startups	008	Safety Policy	
260000 - PA	Electrical - Startups	010	Sub/Supplier Certification Form	
260000 - PA	Electrical - Startups	007	Employee List	
260000 - PA	Electrical - Startups	012	Submit a copy of the Electrical Permit	
260000 - PA	Electrical - Startups	009	SDS Sheets	
260000 - PA	Electrical - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
260000 - PACO	Electrical - Closeouts	014	Consent of Surety	
260000 - PACO	Electrical - Closeouts	013	Contractor (2) Year Guarantee	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
260000 - PACO	Electrical - Closeouts	015	Certificate of Substantial Completion	
260000 - PACO	Electrical - Closeouts	017	As Built Drawings	
260000 - PACO	Electrical - Closeouts	016	Completed Punch List	
260000 - PACO	Electrical - Closeouts	019	Current Certificate of Insurance	
260000 - PACO	Electrical - Closeouts	018	All processed Change Orders Returned	
260000 - PACO	Electrical - Closeouts	021	Asbestos Materials Affidavits	
260000 - PACO	Electrical - Closeouts	020	Signed Hazardous Materials	
260000 - PACO	Electrical - Closeouts	023	Operations & Maintenance Manuals	
260000 - PACO	Electrical - Closeouts	022	Warranties for Equipment Installed	
260000 - PACO	Electrical - Closeouts	025	Inspections & Certificates	
260000 - PACO	Electrical - Closeouts	024	Replacement Parts turned over to Owner	
260000 - PACO	Electrical - Closeouts	027	Inventory of items that have been removed and salvaged for Selective Demo	02 4119
260000 - PACO	Electrical - Closeouts	026	Submit a copy of the Certificate of Acceptance for the Electrical Permit	



Package Number	Package Name	Number	Title	Spec Section Number
260000 - PACO	Electrical - Closeouts	028	Installers Certificates for Penetration Firestopping	07 8413
260000 - PACO	Electrical - Closeouts	029	Dated documents of Torque Valves of Cable Connections on all equipment	26 0519
260000 - PACO	Electrical - Closeouts	031	Operations & Maintenance Manuals for Lighting Control System	26 0943
260000 - PACO	Electrical - Closeouts	030	Operations & Maintenance Manuals for Lighting Control Devices	26 0923
260000 - PACO	Electrical - Closeouts	032	Software and Firmware Operation Documentation for Lighting Control System	26 0943
260000 - PACO	Electrical - Closeouts	033	Manufacturer's Extended Warranty period Failue Due to Transient Voltage Surges for 8 years for Lighting Control System	26 0943
260000 - PACO	Electrical - Closeouts	034	Manufacturer's Extended Warranty period for Electrically Held Relays: for 10 years from Date of Substantial Completion for Lighting Control System	26 0943
260000 - PACO	Electrical - Closeouts	035	Startup Service for Lighting Control System, provide a copy of the Sign in sheet for this.	26 0943
260000 - PACO	Electrical - Closeouts	037	Operations & Maintenance Manuals for Wiring Devices	26 2726
260000 - PACO	Electrical - Closeouts	036	Owner Training for Lighting Control System. Submit a copy of the Sign in Sheet for this training.	26 0943
260000 - PACO	Electrical - Closeouts	038	Maintenance Manuals for Interior Lighting	26 5100
260000 - PACO	Electrical - Closeouts	039	Manufacturer's Warranty for LED Fixtures for 5 years from the Date of Substantial Completion for Interior Lighting.	26 5100
260000 - PACO	Electrical - Closeouts	040	Operations & Maintenance Manuals for Exterior Lighting	26 5600



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
260000 - PACO	Electrical - Closeouts	041	Extra Material: Glass & Plastic Lenses, Covers, and Other Optical Parts: 1 for every 10 of each type and rating installed. Furnish at least 1 of each type. That are packaged with Protective Covering for storage and identified with labels describing contents for Exterior Lighting. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	26 5600
260000 - PACO	Electrical - Closeouts	043	Manufacturer's Warranty for Luminaires for 5 years from the Date of Substantial Completion for Exterior Lighting.	26 5600
260000 - PACO	Electrical - Closeouts	042	Extra Material: Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least 1 of each type. That are packaged with Protective Covering for storage and identified with labels describing contents for Exterior Lighting. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	26 5600
260000 - PACO	Electrical - Closeouts	045	Manufacturer's Warranty for Color Retention for 5 years from the Date of Substantial Completion for Exterior Lighting.	26 5600
260000 - PACO	Electrical - Closeouts	044	Manufacturer's Warranty for Metal Corrosion for 5 years from the Date of Substantial Completion for Exterior Lighting.	26 5600
260000 - PACO	Electrical - Closeouts	046	Manufacturer's Warranty for Poles for 3 years from the Date of Substantial Completion for Exterior Lighting.	26 5600
260000 - PACO	Electrical - Closeouts	047	Manufacturer's Warranty for LED Fixtures for 5 years from the Date of Substantial Completion for Exterior Lighting.	26 5600

Bid Division: 310000 – Site Work

Bid to Include:

Total Responsibility for Specification Sections:

Section 012300 – Alternates
Section 015639 – Temporary Tree and Plant Protection
Section 014000 – Product Requirements
Section 016000 – Product Requirements
Section 024119 – Selective Demolition
Section 116800 – Play Field Equipment and Structures
Section 311000 – Site Clearing
Section 312000 – Earth Moving
Section 312319 – Dewatering
Section 321124 – Aggregate Base
Section 323113 – Chain Link Fences and Gates
Section 323900 – Miscellaneous Site Specialties
Section 329200 – Turf and Grasses
Section 329300 – Plants
Section 330100 – Excavation
Section 332150 – Facility Water
Section 334100 – Storm Utility Drainage Piping
Section 334600 – Subdrainage
Section 334605 – Subdrainage – Flat DRAINTILE

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 078413 – Penetration Firestopping
Section 079200 – Joint Sealants

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Clearing and stump removal of site and building areas, rough and fine grading, mass and building excavation, backfill, import and export of soils/fill, topsoil replacement and seeding. Provide all sand base course material for concrete sidewalks, exterior slabs, pads, etc. including placement, grading and compaction.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a "general contractor" related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor's bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division's work.

Wolgast Corporation – Construction Management

Bid Division: 310000 – Site Work

6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner's dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor's obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Removal of excess spoils generated by this bid division from site.
2. Barricade trees to protect from construction.
3. Excavation for foundation is by the Concrete Contractor - Bid Division 030100.
4. Selective Demolition of site to within 5 feet of building, including but not limited to fencing, asphalt removal, curb, sidewalk, landscaping, concrete stoops, pipe railings, playground equipment, flag pole, etc.
5. Provide de-watering for work in your Bid Division.
6. Furnish and install all gravel base material; finish grading of gravel, compaction and preparation for all placement of asphalt paving.
7. Finish grading of all topsoil, plant beds and seed. Excavation, backfill, removal and disposal of spoil for all planting and landscape items. Repair all areas of construction to original state, or improving upon by seeding. **INCLUDE HERE IF THERE IS NO BID DIVISION 329000.**
8. Review the complete geotechnical report, particularly the soil borings. This Bid Division contractor is responsible to provide all designated fill for this project. Any assumed fill to be used from the project site is at the risk of the Contractor.
9. Provide all aggregate base course and sand cushions directly below concrete slabs on grade for buildings and sidewalks and all other exterior concrete +/- 0.1. Cushions to be depth as indicated in contract documents and specifications.
10. All site demolition required for installation of asphalt work and final site work.

Wolgast Corporation – Construction Management

Bid Division: 310000 – Site Work

11. Engineering layout and grade certifications. All associated excavation, backfill, compaction, and clean up. Connection charges. Street, concrete and pavement cutting, removal, and patching. Barricades and traffic control.
12. Responsible for all required permit for erosion and sedimentation control.
13. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
14. All seeding required for all areas affected by construction.
15. Aggregate base course to be finished graded after placement and also immediately prior to lay down of asphaltic concrete paving.
16. All required topsoil. Topsoil to be graded to + .1 feet of designed finish grade after placement and also immediately prior to landscaping activities.
17. All site utilities as it relates to water, storm, sanitary, and gas to within 5 feet of building.
18. Review soil borings, the Sitework Contractor is responsible to provide all designated fill for this project. Any assumed fill to be used from the project site is at the risk of the Contractor.
19. Provide temporary fencing around all additions during construction.
20. Provide all required permits.
21. Patching of asphalt on parking lot disturbed during construction if caused by this Bid Division.
22. Provide all import fill soils and export of all spoil or unusable soils necessary to complete all work or required by the construction documents.
23. Temporary care & maintenance of all plants and lawns until final completion of all work and acceptance by Owner.
24. Notify and correspond with Miss Dig before work commences and throughout the project.
25. All saw cutting of asphalt and concrete as required on site.
26. Tie into all downspouts within 5 feet of the buildings. (Coordinate with Bid Division 222300 – Mechanical)
27. Furnish and install irrigation sleeves as required.
28. Site work Contractor is responsible to provide, install and maintain all erosion control requirements.

Project Inclusions:

1. To clear and strip the courtyard, including removal of catch basins and fill area.
2. Patching of existing asphalt drive disturbed during construction if caused by this Bid Division.
3. Furnish and install football goal posts per keynote 14 on C2.0.
- 4.
5. Temporary care & maintenance of all plants and wetland areas until final completion of all work and acceptance by owner.

Excludes:

1. Concrete Testing
2. Temporary Bracing.
3. Soil Density Testing
4. Final Site Utility hook-up by Bid Division 222300.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 310000

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

310000 Site Work

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
310000	Site Work	164	Product Data for Penetration Firestopping	07.8413
310000	Site Work	166	Product Data for Joint Sealants	07.9200
310000	Site Work	165	Product Schedule for Penetration Firestopping	07.8413
310000	Site Work	168	Samples for Verification for Joint Sealants	07.9200
310000	Site Work	167	Samples for Initial Selection for Joint Sealants	07.9200
310000	Site Work	170	Shop Drawings for Temporary Tree and Plan Protection	01.5639
310000	Site Work	169	Product Data for Temporary Tree and Plan Protection	01.5639
310000	Site Work	172	Tree Pruning Schedule for Temporary Tree and Plan Protection	01.5639
310000	Site Work	171	Samples for Temporary Tree and Plan Protection	01.5639
310000	Site Work	173	Product Data for Play Field Equipment and Structures	11.6800
310000	Site Work	175	Samples for Initial Selection for Play Field Equipment and Structures	11.6800
310000	Site Work	174	Shop Drawings for Play Field Equipment and Structures	11.6800
310000	Site Work	177	Delegated-Design Submittal for Dewatering	31.2319
310000	Site Work	176	Shop Drawings for Dewatering	31.2319
310000	Site Work	179	Shop Drawings for Chain Link Fences and Gates	32.3113
310000	Site Work	178	Product Data for Chain Link Fences and Gates	32.3113
310000	Site Work	181	Lead Submittals for Miscellaneous Site Specialties	32.3900
310000	Site Work	180	Product Data for Miscellaneous Site Specialties	32.3900
310000	Site Work	182	Samples for Miscellaneous Site Specialties	32.3900
310000	Site Work	183	Samples for Initial Selection for Miscellaneous Site Specialties	32.3900
310000	Site Work	184	Samples for Verification for Miscellaneous Site Specialties	32.3900
310000	Site Work	185	Product Data for Turf and Grasses	32.9200
310000	Site Work	186	Certification and Seed Mix for Turf and Grasses	32.9200



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
310000	Site Work	188	Samples of Mineral Mulch for Plants	32 9300
310000	Site Work	187	Product Data for Plants	32 9300
310000	Site Work	189	Product Data for Facility Water	33 2150
310000	Site Work	190	Product Data for Storm Utility Drainage Piping	33 4100
310000	Site Work	191	Shop Drawings for Storm Utility Drainage Piping	33 4100
310000	Site Work	192	Product Data for Subdrainage	33 4600
310000	Site Work	194	Manufacturer's Literature for Subdrainage - Flat DrainTile	334605
310000	Site Work	193	Product Data for Subdrainage - Flat DrainTile	334605
310000 - PA	Site Work - Startups	001	Signed Post Bid Interview Form	
310000 - PA	Site Work - Startups	002	Schedule of Values	
310000 - PA	Site Work - Startups	003	Signed Contracts Returned	
310000 - PA	Site Work - Startups	004	Payment/Performance Bonds	
310000 - PA	Site Work - Startups	005	Letter of Compliance	
310000 - PA	Site Work - Startups	006	Certificate of Insurance	
310000 - PA	Site Work - Startups	008	Safety Policy	
310000 - PA	Site Work - Startups	007	Employee List	
310000 - PA	Site Work - Startups	010	Sub/Supplier Certification Form	
310000 - PA	Site Work - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
310000 - PA	Site Work - Startups	009	SDS Sheets	
310000 - PACO	Site Work - Closeouts	013	Consent of Surety	
310000 - PACO	Site Work - Closeouts	015	Completed Punch List	
310000 - PACO	Site Work - Closeouts	016	As Built Drawings	
310000 - PACO	Site Work - Closeouts	017	All processed Change Orders Returned	
310000 - PACO	Site Work - Closeouts	018	Current Certificate of Insurance	
310000 - PACO	Site Work - Closeouts	019	Signed Hazardous Materials	
310000 - PACO	Site Work - Closeouts	020	Asbestos Materials Affidavits	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
310000 - PACO	Site Work - Closeouts	012	Contractor (2) Year Guarantee	
310000 - PACO	Site Work - Closeouts	021	Warranties for Equipment Installed	
310000 - PACO	Site Work - Closeouts	014	Certificate of Substantial Completion	
310000 - PACO	Site Work - Closeouts	022	Operations & Maintenance Manuals	
310000 - PACO	Site Work - Closeouts	023	Replacement Parts turned over to Owner	
310000 - PACO	Site Work - Closeouts	024	Inspections & Certificates	
310000 - PACO	Site Work - Closeouts	025	Inventory of items that have been removed and salvaged for Selective Demo	02 4119
310000 - PACO	Site Work - Closeouts	026	Installers Certificates for Penetration Firestopping	07 8413
310000 - PACO	Site Work - Closeouts	027	Maintenance Data for Play Field Equipment and Structures	11 6800
310000 - PACO	Site Work - Closeouts	028	Operations & Maintenance Manuals for Chain Link Fences and Gates	32 3113
310000 - PACO	Site Work - Closeouts	029	Owner Training for Chain Link Fences and Gates. Submit a copy of the Sign in Sheet for this training.	32 3113
310000 - PACO	Site Work - Closeouts	030	Maintenance Data for Miscellaneous Site Specialties	32 3900
310000 - PACO	Site Work - Closeouts	031	Maintenance Instructions for Plants	32 9300
310000 - PACO	Site Work - Closeouts	032	Operations & Maintenance Manuals for Facility Water	33 2150

Bid Division: 321200 – Asphalt Paving

Bid to Include:

Section 012300 – Alternates
Section 014000 – Quality Requirements
Section 016000 – Product Requirements
Section 321216 – Asphalt Paving
Section 321723 – Pavement Markings

Limited Responsibility for Specification Sections (as it relates to work in this Bid Division):

Section 312000 – Earth Moving (As it related to fine grading)

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Fine grading of parking lot base, asphalt concrete paving, lot stripes and markings, final clean of parking lot prior to Owner occupancy.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.

Wolgast Corporation – Construction Management

Bid Division: 321200 – Asphalt Paving

14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Include temporary barricades as required.
2. Placement of asphalt paving.
3. Pavement markings and striping.
4. Finish grading of gravel and preparation for all placement of asphalt paving.
5. Provide cleaning of base coat prior to application of finish coat.
6. Final cleaning of parking lot prior to Owner occupancy.
7. Final adjustment of all structures within the paved areas, prior to top coat being applied.
8. Back dressing of areas affected by the placement of asphalt pavement.

Excludes:

1. Asphalt Testing
2. Compaction Testing.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 321200

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

321200 Asphalt Paving

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
321200	Asphalt Paving	195	Product Data for Asphalt Paving	32 1216
321200	Asphalt Paving	196	Material Certificates for Asphalt Paving	32 1216
321200	Asphalt Paving	198	Samples for Pavement Markings	32 1723
321200	Asphalt Paving	197	Product Data for Pavement Markings	32 1723
321200 - PA	Asphalt Paving - Startups	001	Signed Post Bid Interview Form	
321200 - PA	Asphalt Paving - Startups	002	Schedule of Values	
321200 - PA	Asphalt Paving - Startups	004	Payment/Performance Bonds	
321200 - PA	Asphalt Paving - Startups	003	Signed Contracts Returned	
321200 - PA	Asphalt Paving - Startups	005	Letter of Compliance	
321200 - PA	Asphalt Paving - Startups	006	Certificate of Insurance	
321200 - PA	Asphalt Paving - Startups	008	Safety Policy	
321200 - PA	Asphalt Paving - Startups	007	Employee List	
321200 - PA	Asphalt Paving - Startups	010	Sub/Supplier Certification Form	
321200 - PA	Asphalt Paving - Startups	009	SDS Sheets	
321200 - PA	Asphalt Paving - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
321200 - PACO	Asphalt Paving - Closeouts	012	Contractor (2) Year Guarantee	
321200 - PACO	Asphalt Paving - Closeouts	014	Certificate of Substantial Completion	
321200 - PACO	Asphalt Paving - Closeouts	013	Consent of Surety	
321200 - PACO	Asphalt Paving - Closeouts	015	Completed Punch List	
321200 - PACO	Asphalt Paving - Closeouts	016	As Built Drawings	
321200 - PACO	Asphalt Paving - Closeouts	017	All processed Change Orders Returned	
321200 - PACO	Asphalt Paving - Closeouts	018	Current Certificate of Insurance	
321200 - PACO	Asphalt Paving - Closeouts	019	Signed Hazardous Materials	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
321200 - PACO	Asphalt Paving - Closeouts	020	Asbestos Materials Affidavits	
321200 - PACO	Asphalt Paving - Closeouts	021	Warranties for Equipment Installed	
321200 - PACO	Asphalt Paving - Closeouts	022	Operations & Maintenance Manuals	
321200 - PACO	Asphalt Paving - Closeouts	024	Inspections & Certificates	
321200 - PACO	Asphalt Paving - Closeouts	023	Replacement Parts turned over to Owner	

Bid Division: 321800 – All Weather Synthetic Track Surface

Bid to Include:

Total Responsibility for Specification Sections

Section 014000 – Quality Requirements
Section 016000 – Product Requirements
Section 321823.39 – Synthetic Running Track Surfacing
Section 321823.53 – Tennis Court Surfacing

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

Provide all removal of existing track surfacing, crack and asphalt patching as required, prep and installation of new track surfacing for a complete installation.

General Inclusions:

1. There is no general contractor associated with this project; any and all reference to a “general contractor” related to the work of this bid division shall be understood to mean the contractor of this bid division.
2. The contractor for this bid division work is required to include but is not limited to all items, services, tasks, materials, personnel, equipment, etc. identified in this bid division description regardless of the presence of language in other bid division descriptions that is the same or is similar to that found in this contractor’s bid division description.
3. Coordination of the work of this bid division with any and all work of other bid division contractors for the scheduling and integration of the work of this contractor.
4. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division’s work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner’s dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete the work to deliver a fully operational system in compliance with all governing codes.
8. This Contractor shall be responsible for performing all work in full compliance with all health and safety standards including Asbestos Awareness and Notification, Lead Paint Abatement, and all MIOSHA Standards. This Contractor shall also be responsible for satisfying all safety violations and/or fines resulting from the actions or lack of action by this Contractor at the sole expense of this Contractor.
9. Any contractor who compounds a mistake by installing their product on another Contractor’s obvious faulty work will assume responsibility for repair of said work.
10. This contractor shall repair and restore any damaged area to an original or better condition with no detectable evidence that the area has been repaired. Repairs must be done by personnel qualified in the execution of the work skilled and licensed in that trade. Whenever possible, repairs to work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner’s Notice to commence work.
12. Must provide all submittals within 15 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all layout and measurements required to perform the work of this Bid Division.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) in advance of the delivery, and provide proper personnel and equipment to perform the unloading.

Wolgast Corporation – Construction Management

Bid Division: 321800 – All Weather Synthetic Track Surface

16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, the Contractor must update the Master Copy of As-Builts, as it applies to the work of their Bid Division.
19. Wolgast uses Procore for their CM Software. Please note: We will upload all drawings and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.

Division Inclusions:

1. All markings and striping.
2. All track surfacing at track and field events.
3. Provide engineered layout of all event markings.

Project Inclusions:

1. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources.
2. Install new track surface on all associated field events.
3. This contractor must accept the asphalt surface in writing prior to installing the track surface.
4. Install all field and court markings per Michigan High School Athletic Association standards.
5. Prepare renderings of all markings and review with Owner prior to placement.
6. Install per specifications and manufacturer's instructions.
7. Must provide all submittals within 15 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
8. Mandatory attendance at all required pre-installation meetings.
9. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 321800

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

321800 All Weather Synthetic Track Surface

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
321800	All Weather Synthetic Track Surface	200	Samples for Synthetic Running Track Surfacing	321823.39
321800	All Weather Synthetic Track Surface	199	Product Data for Synthetic Running Track Surfacing	321823.39
321800	All Weather Synthetic Track Surface	201	Material Test Reports for Synthetic Running Track Surfacing	321823.39
321800	All Weather Synthetic Track Surface	202	Product Data for Tennis Court Surfacing	32 1823.53
321800	All Weather Synthetic Track Surface	203	Samples for Tennis Court Surfacing	32 1823.53
321800	All Weather Synthetic Track Surface	204	Test Reports for Tennis Court Surfacing	32 1823.53
321800 - PA	All Weather Synthetic Track Surface - Startups	001	Signed Post Bid Interview Form	
321800 - PA	All Weather Synthetic Track Surface - Startups	002	Schedule of Values	
321800 - PA	All Weather Synthetic Track Surface - Startups	004	Payment/Performance Bonds	
321800 - PA	All Weather Synthetic Track Surface - Startups	003	Signed Contracts Returned	
321800 - PA	All Weather Synthetic Track Surface - Startups	005	Letter of Compliance	
321800 - PA	All Weather Synthetic Track Surface - Startups	006	Certificate of Insurance	
321800 - PA	All Weather Synthetic Track Surface - Startups	008	Safety Policy	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
321800 - PA	All Weather Synthetic Track Surface - Startups	007	Employee List	
321800 - PA	All Weather Synthetic Track Surface - Startups	010	Sub/Supplier Certification Form	
321800 - PA	All Weather Synthetic Track Surface - Startups	009	SDS Sheets	
321800 - PA	All Weather Synthetic Track Surface - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	012	Contractor (2) Year Guarantee	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	014	Certificate of Substantial Completion	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	013	Consent of Surety	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	016	As Built Drawings	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	017	All processed Change Orders Returned	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	015	Completed Punch List	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	019	Signed Hazardous Materials	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	018	Current Certificate of Insurance	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	021	Warranties for Equipment Installed	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	020	Asbestos Materials Affidavits	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	022	Operations & Maintenance Manuals	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	023	Replacement Parts turned over to Owner	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	024	Inspections & Certificates	
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	025	Manufacturer's Warranty for 5 years for Synthetic Running Track Surfacing	321823.39
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	026	Extra Material: Touch Up Paint: Provide Owner with 5 gallons of each color, plus 1 gallon of striping paint for future touch up. That are packaged with Protective Covering for storage and identified with labels describing contents for tennis Court Surfacing. Submit a Copy of the Signed Transmittal as Proof of Delivery to Owner.	321823.53
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	027	Maintenance Data for Tennis Court Surfacing	321823.53
321800 - PACO	All Weather Synthetic Track Surface - Closeouts	028	Manufacturer's Warranty for 5 years for Tennis Court Surfacing	321823.53

Bid Division: 321813 – Synthetic Turf

Bid to Include:

Total Responsibility for Specification Sections

Section 014000 – Quality Requirements
Section 016000 – Product Requirements
Section 321813 – Synthetic Grass Surfacing
Section 321852 – Performance Shock Pad

Limited Responsibility for Specification Sections: (As it relates to work in this Bid Division)

Section 012300 – Alternates
Section 116800 – Play Field Equipment and Structures

Provide all labor, materials, tools, and equipment necessary to perform the work of the specified bid sections. The contractor must also furnish, deliver, unload, store, protect, erect and install all items required for the completion of the work of this bid division in compliance with all drawings and specifications for a complete operational system including but not limited to:

General Inclusions:

1. There is no general contractor on this project. The respective trades assigned to that work by the bid division description(s) will perform any work referenced to general contractors.
2. Coordination with other bid divisions.
3. All contractors are responsible for the entire set of plans and specifications; including tables, schedules, and notes.
4. Contractor shall be responsible for all lay-out for every component of the contractor's work and the coordination of such work with the work of all other contractors.
5. Provide continuous housekeeping and clean-up, and proper legal off-site disposal of any debris generated by this Bid Division's work.
6. Contractor is responsible for own dumpster(s) and all removal and disposal charges thereof. (Use of the Owner's dumpsters is strictly prohibited.)
7. All Contractors are required to inspect the existing project components and are to include all work necessary to complete a full operational system in compliance with all governing codes.
8. This Contractor is responsible for all safety issues for all work that he has effected until his project is complete.
9. Any contractor who compounds a mistake by installing their product on another Contractor's obvious faulty work will assume responsibility for repair of said work.
10. Repair – must restore any damaged area to original or better condition with no detectable evidence that the area has been repaired. Repairing must be done by personnel qualified in the execution of the work for the appropriate affected trade. Whenever possible, repairing of work shall be done by the original installer of the work.
11. Submittal of all insurance, unit pricing, schedule of values, required product data and shop drawings within (2) two weeks of Owner's Notice to commence work.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Provide all required layout.
14. The Owner reserves the right to salvage any materials removed from the site during the duration of the project.
15. Coordinate delivery of materials with Construction Manager (48 hours) prior to unloading.
16. Contractor shall submit to the field construction manager a complete written daily field report stating the work being done on site and the number of employees performing the work for each day the Contractor has representatives on site.
17. Contractor shall have a supervisor on site at all times when a crew is present on the job.
18. On Friday, or last workday of each week, Contractors must update the Master Copy of As-Builts, as it applies to their Bid Division.

Wolgast Corporation – Construction Management

Bid Division: 321813 – Synthetic Turf

19. **Wolgast uses Procore for their CM Software. Please note: We will upload all drawings, and drawing revisions as they are approved, to the Drawings tool. However, it is each contractor's responsibility to verify that they are working from the most up-to-date, approved, drawings.**

Division Inclusions:

1. Removal from the site excess spoils generated by the Bid Division contractor.
2. Furnish and install all under drainage with filter sock.
3. Furnish and install (collector piping) storm piping into storm structures.
4. Install turf over manholes as indicated.
5. Provide field markings in accordance with NFHS and plan designs including school logo and end zone lettering.
6. Certify grade prior to installing turf.
7. Furnish and install all required turf nailers and pins.
8. Provide cutting of existing track to achieve straight edge detail.
9. Provide all base courses and sub-base materials placed and compacted per specifications and manufacturer requirements.
10. Manufacture to verify and certify designed drainage system and report any discrepancy prior to installing.
11. Submit samples upon request.
12. Provide reference for installed fields upon request.
13. Provide warranties per specification minimum (8) eight years from date of Substantial Completion.
14. Furnish extra materials per spec, 500 lbs of rubber granules, 15'x10" of turf.
15. Furnish and install complete operational drainage system into storm basins.
16. Furnish and install complete turf system.
17. Furnish and install all rubber infill material.
18. Provide all field markings.
19. Provide school district with one pull behind drag brush.
20. Remove and replace any damaged misaligned materials caused by this Bid Division contractor.
21. Complete and submit special project guarantee.
22. Furnish and install specified combination goal posts.
23. Provide all geo textile fabric.

Project Inclusions:

1. Review the milestone schedule. Prepare your bid proposal accordingly to allow for sufficient manpower and resources.
2. Furnish and install the complete under drainage system. This contractor to furnish and install all storm water drainage work under the turf field. Refer to keynotes 13, 19 and 25. All other storm water drainage work will be the responsibility of the site work bid division. The two bid divisions will need to coordinate prior to the work starting.
3. Furnish and install synthetic turf to all storm structure covers.
4. Protect existing track surface or exposed asphalt paving when crossing the track. If damaged by this contractor, then this contractor will be responsible for repair costs.
5. Furnish and install all field markings as indicated.
6. Remove all spoils from site generated by this contractor.
7. Final clean-up of turf field and debris on track from this contractor.
8. Furnish extra material as indicated.
9. Provide all required instructional training to school district regarding proper maintenance.
10. Replace damaged material prior to Owner turnover.
11. Provide special project warranty upon completion to school district.
12. Must provide all submittals within 20 working days of contract award or sooner, unless specifically clarified with the construction manager prior to contract award.
13. Mandatory attendance at all required pre-installation meetings.

Bid Division: 321813 – Synthetic Turf

14. Completion of all punch list work within 5 working days or less upon receipt of punch list items, unless specific circumstances occur that are out of control of this bid division contractor dictate otherwise.

Consideration for award:

The ability to begin as soon as areas of work become available. To have proper equipment and responsible personnel to complete the above list of work. To repair any adjacent materials damaged in the execution of the above listed work. Close cooperation with the Construction Manager and other bid divisions to provide input to develop a working schedule. An approved schedule of values will be required before approval is granted for the first payment request. Expediting communication and follow-up as required.

END OF BID DIVISION 321813

Wolgast Corporation – Construction Management



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Hemlock - Bid Package #1

321813 Synthetic Turf

Submittals

Package Number	Package Name	Number	Title	Spec Section Number
321813	Synthetic Turf	205	Product Data for Play Field Equipment and Structures	11 6800
321813	Synthetic Turf	206	Shop Drawings for Play Field Equipment and Structures	11 6800
321813	Synthetic Turf	207	Samples for Initial Selection for Play Field Equipment and Structures	11 6800
321813	Synthetic Turf	208	Product Data for Synthetic Grass Surfacing	321813
321813	Synthetic Turf	209	Shop Drawings for Synthetic Grass Surfacing	321813
321813	Synthetic Turf	210	Samples for Synthetic Grass Surfacing	321813
321813	Synthetic Turf	212	Shop Drawings for Performance Shock Pad	321852
321813	Synthetic Turf	214	Samples for Verification for Performance Shock Pad	321852
321813	Synthetic Turf	216	Installation Instructions for Performance Shock Pad	321852
321813	Synthetic Turf	211	Product Data for Performance Shock Pad	321852
321813	Synthetic Turf	213	Samples for Initial Selection for Performance Shock Pad	321852
321813	Synthetic Turf	215	Test Data for Performance Shock Pad	321852
321813 - PA	Synthetic Turf - Startups	001	Signed Post Bid Interview Form	
321813 - PA	Synthetic Turf - Startups	003	Signed Contracts Returned	
321813 - PA	Synthetic Turf - Startups	002	Schedule of Values	
321813 - PA	Synthetic Turf - Startups	005	Letter of Compliance	
321813 - PA	Synthetic Turf - Startups	004	Payment/Performance Bonds	
321813 - PA	Synthetic Turf - Startups	007	Employee List	
321813 - PA	Synthetic Turf - Startups	006	Certificate of Insurance	



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
321813 - PA	Synthetic Turf - Startups	008	Safety Policy	
321813 - PA	Synthetic Turf - Startups	009	SDS Sheets	
321813 - PA	Synthetic Turf - Startups	010	Sub/Supplier Certification Form	
321813 - PA	Synthetic Turf - Startups	011	AHERA Notification and Contractor Compliance Affidavit	
321813 - PACO	Synthetic Turf - Closeouts	012	Contractor (2) Year Guarantee	
321813 - PACO	Synthetic Turf - Closeouts	013	Consent of Surety	
321813 - PACO	Synthetic Turf - Closeouts	014	Certificate of Substantial Completion	
321813 - PACO	Synthetic Turf - Closeouts	015	Completed Punch List	
321813 - PACO	Synthetic Turf - Closeouts	016	As Built Drawings	
321813 - PACO	Synthetic Turf - Closeouts	018	Current Certificate of Insurance	
321813 - PACO	Synthetic Turf - Closeouts	017	All processed Change Orders Returned	
321813 - PACO	Synthetic Turf - Closeouts	020	Asbestos Materials Affidavits	
321813 - PACO	Synthetic Turf - Closeouts	019	Signed Hazardous Materials	
321813 - PACO	Synthetic Turf - Closeouts	022	Operations & Maintenance Manuals	
321813 - PACO	Synthetic Turf - Closeouts	021	Warranties for Equipment Installed	
321813 - PACO	Synthetic Turf - Closeouts	023	Replacement Parts turned over to Owner	
321813 - PACO	Synthetic Turf - Closeouts	024	Inspections & Certificates	
321813 - PACO	Synthetic Turf - Closeouts	026	Project Record Documents for Synthetic Grass Surfaces	321813



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
PACO	Closeouts			
321813 - PACO	Synthetic Turf - Closeouts	025	Maintenance Data for Play Field Equipment and Structures	11 6800
321813 - PACO	Synthetic Turf - Closeouts	027	Maintenance Data for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	028	Manufacturer's Warranty for 8 years for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	030	Manufacturer must provide 3 complete sets of the maintenance guidelines to facility maintenance staff in both manual and electronic format for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	029	The Contractor shall train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended Maintenance Equipment for Synthetic Grass Surfacing. Submit a Copy of the Sign in sheet for this training.	321813
321813 - PACO	Synthetic Turf - Closeouts	032	Submit a copy of product 16 year warranty coverage for Performance Shock Pad	321852
321813 - PACO	Synthetic Turf - Closeouts	031	Owner Training for Synthetic Grass Surfaces. Submit a copy of the Sign in Sheet for this training.	321813
321813 - PACO	Synthetic Turf - Closeouts	017	All processed Change Orders Returned	
321813 - PACO	Synthetic Turf - Closeouts	019	Signed Hazardous Materials	
321813 - PACO	Synthetic Turf - Closeouts	018	Current Certificate of Insurance	
321813 - PACO	Synthetic Turf - Closeouts	020	Asbestos Materials Affidavits	
321813 - PACO	Synthetic Turf - Closeouts	021	Warranties for Equipment Installed	
321813 - PACO	Synthetic Turf - Closeouts	022	Operations & Maintenance Manuals	
321813 - PACO	Synthetic Turf - Closeouts	023	Replacement Parts turned over to Owner	
321813 - PACO	Synthetic Turf - Closeouts	024	Inspections & Certificates	
321813 - PACO	Synthetic Turf - Closeouts	025	Maintenance Data for Play Field Equipment and Structures	11 6800
321813 - PACO	Synthetic Turf - Closeouts	026	Project Record Documents for Synthetic Grass Surfaces	321813



Wolgast Corporation
 Job #: A22913-01 Hemlock Schools - BP #1
 200 Wilson St
 Hemlock, Michigan 48626
 9896425282

Package Number	Package Name	Number	Title	Spec Section Number
321813 - PACO	Synthetic Turf - Closeouts	027	Maintenance Data for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	028	Manufacturer's Warranty for 8 years for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	030	Manufacturer must provide 3 complete sets of the maintenance guidelines to facility maintenance staff in both manual and electronic format for Synthetic Grass Surfacing	321813
321813 - PACO	Synthetic Turf - Closeouts	029	The Contractor shall train the Owner's facility maintenance staff in the use of the Turf Manufacturer's recommended Maintenance Equipment for Synthetic Grass Surfacing. Submit a Copy of the Sign in sheet for this training.	321813
321813 - PACO	Synthetic Turf - Closeouts	032	Submit a copy of product 16 year warranty coverage for Performance Shock Pad	321852
321813 - PACO	Synthetic Turf - Closeouts	031	Owner Training for Synthetic Grass Surfaces. Submit a copy of the Sign in Sheet for this training.	321813

PART 1 – GENERAL

1.01 DEFINITION

- A. Clarification Request forms shall be used to document all questions regarding bidding documents and technical specifications. Please use **ONE** Clarification Form for each item.
- B. The Clarification Request form follows as page 2 of this Section.

1.02 PREPARATION OF CLARIFICATION REQUEST FORM

- A. The Contractor shall complete the following items on the Clarification Request form:
 - 1. Date
 - 2. Contractor Name
 - 3. Contractor contact person
 - 4. Contractor email, phone, and fax number
 - 5. Item(s) for clarification
- B. The Contractor shall forward the Clarification Request form, via fax or email, to the Construction Manager **no later than 5 days prior to bid due date**. Request from bidders for clarification, or interpretation of the bidding documents must reach the Project Team five days before the bid date, or by the date addressed in the pre-bid agenda. Any bidder clarifications which reach the project team after such dates have passed will not be considered.

1.03 RESPONSIBILITIES FOR COMPLETION OF CLARIFICATION REQUEST FORMS

- A. The Construction Manager shall review and number Clarification Request forms as they are received.
- B. Clarification Requests regarding BIDDING INSTRUCTIONS OR PROCEDURES shall be answered by the Construction Manager.
- C. Clarification Requests regarding the DESIGN and/or TECHNICAL SPECIFICATIONS shall be answered by the Architect. The Construction Manager shall forward technical specification clarifications to the Architect, via fax or mail, as they are received.

1.04 RESPONSE TO CLARIFICATION REQUEST FORMS

- A. The Architect shall review each Clarification Request form received, and return responses to the Construction Manager.
- B. As noted in Items 1.03.B and 1.03.C above, it is the responsibility of both the Construction Manager and the Architect to respond to Clarification Request forms.
- C. Responses shall be issued via the “Response” section of the Clarification Request form or Addenda.

CLARIFICATION REQUEST FORM

Date: _____

Wolgast Clarification Request
#: _____

To: Wolgast Corporation
Craig Myers at cra.mye@wolgast.com or Donna Ratzlaff at donna.ratzlaff@wolgast.com
4835 Towne Centre Road, Suite 203
Saginaw, MI 48604
Phone (989) 790-9120, Fax (989) 790-9063

From: _____
Contractor Name

Contact Name

Email Address

Phone # _____ Fax # _____

Bid Division # and Name: _____

CSI Code (If Applicable): _____

Drawing #: _____ Detail or Item #: _____

Reason for Request: More Detail Needed Engineering Clarification Alternate Proposal Other

Project: **Hemlock Public Schools**

Site Location: **Bid Package #1**

ITEM(S) FOR CLARIFICATION OF BID: (Please use one form for each item)

Please review and respond to the following item(s) for clarification:

RESPONSE: **ITEM TO BE INCLUDED IN ADDENDUM**

Construction Manager: _____
Signature Date

Architect: _____
Signature Date

END OF SECTION 00310

PART 1 – GENERAL

1.01 BID SECURITY

- A. Each Proposal shall be accompanied by Bid Security pledging that the Bidder will enter into a contract with the Owner on the terms stated in the Proposal, and will, if required, furnish bonds as described in Section 00600. Should the Bidder refuse to enter into such contract or fail to furnish such Bonds, the amount of the Bid Security shall be forfeited to the Owner as liquidated damages, not as a penalty.
- B. Bid Security shall be in the amount of five percent (5%) of the Base Bid(s).
- C. Bid Security for each Proposal containing Bids for multiple Bid Divisions shall be in the amount of five percent (5%) of the total Base Bids for the highest-priced combination of Bid Divisions included in the Proposal
- D. Bid Security may take the form of a **Bid Bond, a Cashier's Check, or a Money Order made payable to the Owner.** When submitting a Cashier's Check or Money Order a separate check or money order must accompany each Bid Division.
- E. Bid Security that is in the form of a Cashier's Check or Money Order will be returned to Bidders within a reasonable period after construction contracts have been executed, returned and approved by the Owner.

END OF SECTION 00410

PART 1 – GENERAL

1.01 OWNER/CONTRACTOR AGREEMENT

- A. The Agreement between the Owner and the Contractor will be written on the Owner's standard Owner/Contractor Agreement Form. A sample of this Form appears as Section 00510.
- B. The Owner/Contractor Agreement Form will be filled in by the Owner, as appropriate for each Contractor and will be sent to each Contractor.
- C. The executed Owner/Contractor Agreement, the General Conditions and the other Contract Documents will be the entire, integrated Contract between the Owner and each Contractor.
- D. Upon receipt of an Owner/Contractor Agreement, each successful Bidder shall review it for completeness and accuracy, execute it and return it to the Owner's Representative for delivery to the Owner.
- E. Each successful Bidder shall submit all required post-bid documents, including Labor and Material Payment Bond and Performance Bond (Section 00600) unless waived by the Owner, Certificates of Insurance (Section 00650), Schedule of Values (Section 00670), Subcontractor and Supplier Listing (Section 00680), and Employee Listing (Section 00690) as a prerequisite to execution of the Owner/Contractor Agreement
- F. The Owner will execute each Owner/Contractor Agreement after it has been properly executed by the Bidder and after all required post-bid documents have been submitted.

1.02 NOTICE TO PROCEED

- A. The Owner may elect to issue Notices to Proceed prior to the execution of Owner/Contractor Agreements.
- B. Upon receipt of Notice to Proceed, each Contractor shall commence work in accord with the conditions contained in the Notice to Proceed
- C. Regardless of the provisions of any Notice to Proceed or of this Section, no Contractor shall commence work until all required insurance is in force and Certificates of Insurance (Section 00650) have been submitted to the Owner's Representative for delivery to the Owner.
- D. Prior to commencement of work, Contractors shall submit evidence satisfactory to the Owner that required bonds will be furnished and shall deliver the Bonds by the date the Contractor executes the Owner/Contractor Agreement.
- E. The Owner may include Notice to Proceed in Purchase Orders.

1.03 COMMENCEMENT OF WORK

- A. Each Contractor shall commence work immediately upon receipt of Notice to Proceed under the conditions contained in the Notice to Proceed or upon execution of an Owner/Contractor Agreement, whichever is earlier.

END OF SECTION 00500

**SAMPLE
OWNER-CONTRACTOR
CONTRACT ON
FOLLOWING PAGE**

END OF SECTION 00510



Document A132™ - 2019

Standard Form of Agreement between Owner and Contractor, Construction Manager as Adviser Edition

AGREEMENT made as of the «Day» of «Month» in the year «Year»
(in words, indicate day, month and year)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Owner Name»
«Owner Address»
«Owner CSZ»

Telephone:
Facsimile:

and the Contractor:
(Name, legal status, address and other information)

«Contractor Name»
«Contractor Address»
«Contractor CSZ»

Telephone:
Facsimile:

for the following Project:
(Name, legal status, address and other information)

«Site Location»
«Project Name»
«Site Address»
«Site CSZ»

«Bid_Division» - «Bid_Div_Description»

The Construction Manager is:
(Name, legal status, address and other information)

Wolgast Corporation
4835 Towne Centre Road, Suite 203
Saginaw, MI 48604
Telephone: (989) 790-9120
Facsimile: (989) 790-9063

The Architect is:
(Name, legal status, address and other information)

«Architect Name»
«Architect Address»
«Architect CSZ»

Telephone:
Facsimile:

The Owner and Contractor agree as set forth below.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Documents A232™-2019, General Conditions of the Contract for Construction. Construction Manager as Adviser Edition: B132™-2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™-2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

AIA Document A232™-2019 is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

1	THE CONTRACT DOCUMENTS
2	THE WORK OF THIS CONTRACT
3	DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION
4	CONTRACT SUM
5	PAYMENTS
6	DISPUTE RESOLUTION
7	TERMINATION OR SUSPENSION
8	MISCELLANEOUS PROVISIONS
9	ENUMERATION OF CONTRACT DOCUMENTS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others, or as follows:

§ 2.1 Provide all work described by but not limited to Bidding Requirements, Contract Forms and Conditions of the Contract, Additional Conditions of the Contract, General Conditions of the Contract for Construction, Division 1 General Requirements and:

BID DIVISION: «Bid_Division» - «Bid_Div_Description»

Provide all labor, materials, tools and equipment necessary to perform the work of the specified bid sections. The Contractor must also furnish, deliver, unload, store, protect erect and install all items required for the satisfactory completion of the work of this bid division (as indicated on drawings and associated specifications.) Including but not limited to:

«Written_Description»

INCLUDING SECTIONS: «Including_Sections1»

Limited Responsibility: «Limited_Responsibility»

§ 2.2 Pre-Bid Meeting Agenda and Meeting Minutes dated: «Pre_Bid_Date»

§ 2.3 Post-Bid Interview dated: «Post_Bid_Interview_Date»

§ 2.4 Pre-Construction Meeting Agenda and Meeting Minutes dated: «Pre_Con_Date»

§ 2.5 Performance Bond and Labor and Material Payment Bond required: «Bond_Required»

§ 2.6 Project Start Date: «Project_Start_Date»

§ 2.7 Completion Date: «Completion_Date»

- § 2.8 All submittals and shop drawings required by the specifications must be submitted by: «Submittals Due By»
- § 2.9 Provide all clean-up and legal off-site disposal of all debris generated by any work performed by this Contract including general housekeeping of employee generated trash and garbage (i.e. drink cups, food wrappers, bag, etc.).
- § 2.10 The Bid Division Description(s) identify the scope of work, areas of responsibility and specific work to be included in the Contract Amount. If any conflict is found between the architect/engineer specifications and the Bid Division Descriptions regarding the scope of work to be performed, the Bid Division Description(s) shall govern. Further, if a conflict occurs between the Bidding Requirements, the General Requirements, the Specifications, the Bid Division Description(s), the Drawings, or the Addenda(s), the most stringent requirement shall apply.
- § 2.11 Other Special provisions: Article 8.6
- § 2.12 Compliance with EPA AHERA for Asbestos: The Contractor must adhere to all EPA AHERA and Michigan State Asbestos Regulations for Asbestos and other hazardous materials.
- § 2.13 Compliance with Lead-Containing Materials: All Contractors, Subcontractors and Sub-Subcontractors shall adhere to the Environmental Protection Agency (EPA) lead-based paint regulation titled the “Renovation, Repair and Painting (RRP) Rule”. Included under this law are “Child Occupied Facilities” (COFs). COFs encompass locations of pre-1978 constructed buildings where children under age six (6) regularly visits, such as kindergarten rooms, 1st grade classrooms, applicable restrooms, pre-school and day care centers. Therefore, portions of each pre-1978 constructed school building falls under the RRP Rule. Any contractor working on this project who disturbs painted surfaces in COF spaces shall ensure that they adhere to all aspects of the RRP Rule. This includes but is not limited to meeting the requirements for being a Certified Firm, having a Certified Lead Renovator involved and following applicable lead safe work practices. Furthermore, all Contractors shall be responsible to comply with all applicable Federal and Michigan State lead regulations including, but not limited to, 29 CFR Part 1926.62 of the OSHA Lead Construction Standards, (Part 603 of the Michigan State Standards). All costs associated with regulatory compliance shall be borne by the Contractor.
- § 2.14 This Contractor is responsible for all safety issues for all work that he has effected until this project is complete.

ARTICLE 3 DATE OF COMMENCEMENT AND DATES OF SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

- The date of this Agreement.
- A date set forth in a notice to proceed issued by the Owner.
- Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion of the Project or Portions Thereof

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the date of Substantial Completion of the Work of all of the Contractors for the Project will be : See Milestone Schedule for details
(Insert the date of Substantial Completion of the Work of all Contractors for the Project.)

«Substantial Completion Date»

§ 3.3.2 The Contractor agrees that time is of the essence and to start work when directed by the Construction Manager and to furnish sufficient materials and a sufficient number of properly skilled works, so as not to delay the work of any other Contractor or completion of the project.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor’s performance of the Contract. The Contract Sum shall be one of the following:
(Check the appropriate box.)

- Stipulated Sum, in accordance with Section 4.2 below:
- Cost of the work plus the Contractor’s Fee without a Guaranteed Maximum Price, in accordance with Section 4.3 below:
- Cost of the Work plus the Contractor’s Fee with a Guaranteed Maximum Price, in accordance with Section 4.4 below

(Based on the selection above, complete Section 4.2, 4.3 or 4.4 below.)

§ 4.2 Stipulated Sum

§ 4.2.1 The Stipulated Sum shall be «Contract Amount Spelled» Dollars (\$«Contract Amount s»), subject to additions and deductions as provided in the Contract Documents.

Contract amount includes: Base Bid \$«Base Bid Amount», PLM Bond Amount \$«Bond Amount », Alternates \$«Alternate Amount» totaling \$«Contract Amount s».

§ 4.2.2 Alternates

§ 4.2.2.1 Alternates, if any, included the Contract Sum:

Item	Price
<u>«Alternate Description»</u>	

§ 4.2.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
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§ 4.2.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
------	-------

§ 4.2.4 Unit Prices, if any:

(Identify the item and state the unit price, and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 The Construction Manager will provide a Contractor Invoice Form to the Contractor for submitting the Contractor’s request for payment each month. All reference to “Application for Payment” or “Progress Payment Request” shall mean “Contractor Invoice Form”. Based upon Applications for Payment submitted to the Construction Manager by the Contractor and upon certification of the Application for Payment by the Construction Manager and Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor, as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

See Contractor Invoice Form Due Date on Attachment “A”

§ 5.1.3 Provided an Application for Payment is received by the Construction Manager not later than the “Contractor Invoice Form Due Date” found on Attachment “A”, the Owner shall make payment of the amount certified in the Application for Payment to the Contractor for all undisputed amounts not later than forty-five (45) days after the “Owner Approves Invoice” date found on Attachment “A”. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment for all undisputed amounts shall be made by the Owner after the Construction Manager receives the Application for Payment and at the payment date for the Applications for Payment of the following month.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Progress Payments Where the Contract Sum is Based on a Stipulated Sum

§ 5.1.4.1 Each Contractor Invoicing Form and CM prepared Progress Payment Request Form shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Construction Manager and Architect may require. This schedule of values, unless objected to by the Construction Manager, shall be used as a basis for reviewing the Contractor’s Invoicing Form and CM prepared Progress Payment Form.

§ 5.1.4.2 The Contractor Invoicing Form shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.4.3 In accordance with AIA Document A232™-2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.4.3.1 The amount of each progress payment shall first include:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of ten percent (10%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.9 of the General Conditions; and
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing, less retainage of ten percent (10%); and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect’s professional judgment, to be reasonably justified; and
- .4 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to ninety percent (90%) of the Contract Sum, less such amounts as the Construction Manager and Owner recommends and the Architect determines for incomplete Work and unsettled claims; and
- .5 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of the General Conditions.

§ 5.1.4.3.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner.
- .2 The amount, if any, for Work that remains uncorrected and for which the Construction Manager or Architect has previously withheld or nullified a Certificate for Payment as provided in Article 9 of AIA Document A232-2019.
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay.
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A232-2019; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.4.4 The Contractor shall submit to the Construction Manager an itemized progress payment request by the date required in Section 01045 of the Project Manual. The progress payment request is referred to as the Contractor Invoice Form. After the schedule of values is submitted to and approved by the Construction Manager, the Construction Manager will prepare a Contractor Invoice Form master template in accordance with the approved schedule of values and provide it to the Contractor for use to prepare all progress payment requests. The Contractor shall submit a signed and notarized original Contractor Invoice Form for each monthly progress payment request. It shall be accompanied by such supporting data and documents the Owner, Construction Manager and Architect may require substantiating the Contractor's right to payment.

1. Contractor Invoice Form as defined as: See Section 1045 (Contractors Application for Payment)
2. Cost Control Manual as defined as: See Section 1045 (Contractors Application for Payment)
3. Progress Payment Request as defined as: See Section 1045 (Contractors Application for Payment)

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to when the Work of this Contract is substantially complete, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Ten percent (10%) retainage

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

(If the retainage established in Section 5.1.7.1 is to be modified prior to when the entire Work of this Contract is substantially complete, including modifications for completion of portions of the Work as provided in Section 3.4.2, insert provisions for such modifications.)

Ten percent (10%) retainage shall be held back until the project is complete.

§ 5.2 Final Payment

§ 5.2.1 Final Payment Where the Contract Sum is Based on a Stipulated Sum

§ 5.2.1.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A232-2019, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment or Project Certificate for Payment has been issued by the Architect.

§ 5.2.1.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the final Certificate for Payment or Project Certificate for Payment, or as follows:

§ 5.2.1.3 The following must be submitted to the Construction Manager before the acceptance and submission of final payment in addition to requirements of other sections:

- .1 All required closeout documents including warranties, guarantees, operation and maintenance documents, and training;
- .2 As-Builts Drawings;
- .3 Itemized lists of all surplus and extra materials required per specifications at which time the Construction Manager will schedule the delivery of such materials to the Owner by the Contractor;
- .4 Consent of Surety to Final Payment;
- .5 Submit Releases and Final Unconditional Waivers of Lien from all suppliers and subcontractors;
- .6 Submit certification stating that no materials containing asbestos were incorporated into the Work;
- .7 Submit certification that all punch list items have been completed.

§ 5.3 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

Five Percent (5%) per annum % See MCL 438.31

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as Initial Decision Maker pursuant to Section 15 of AIA Document A232-2019, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

N/A

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Section 15 of AIA Document A232-2019, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- Arbitration pursuant to Section 15 of AIA Document A232-2019
- Litigation in a court of competent jurisdiction
- Other: *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

§ 6.2.1 In an effort to resolve any conflicts that arise during the construction of the Project or following the completion of the project, the Owner and the Contractor agree that all disputes between them arising out of or relating to this Agreement shall be submitted to non-binding mediation, unless the parties mutually agree otherwise. All parties shall endeavor to settle disputes by mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Demand for mediation shall be filed in writing with the other party of this Agreement and with the American Arbitration Association. A demand for mediation shall be made within a reasonable time after the claim, dispute, or other matter in writing to the other party. In the event non-binding mediation fails to resolve any or all of the disputes or claims, the parties may pursue relief through any other legal and/or equitable means.

§ 6.2.2 The Owner reserves the right in its discretion to require consolidation or joinder of any mediation relating to this Agreement with another mediation involving an independent contractor or consultant engaged by the Owner in connection with the Project. Agreement in the event the Owner believes such consolidation or joinder is necessary in order to resolve a dispute or avoid duplication of time, expense, or effort.

§ 6.2.3 In the event the Owner is involved in a dispute which is not subject to mediation involving a person or entity not a party to this Agreement, the mediation provision of this Article shall be deemed to be void and nonexistent in the event the Owner, in its discretion, determines the Contractor should become a part to that dispute by joinder or otherwise.

§ 6.2.4 The Owner reserves the right to require any mediation to be held near the Owner's principal place of business.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 Where the Contract Sum is a Stipulated Sum

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§ 7.1.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A232-2019.

§ 7.1.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A232-2019.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A232-2019 or another Contract Document, the reference refers to that provision as amended or supplemented therein, or as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

«Owner Name»
«Owner Address»
«Owner CSZ»

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

«Contractor Name»
«Contractor Address»
«Contractor CSZ»

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A132™-2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, and elsewhere in the Contract Documents.

Type of Insurance	Limit of Liability (\$0.00) Per Specifications
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§ 8.5.2 The Contractor shall provide bonds as set forth in Article 11 of AIA Document A132™-2019, and elsewhere in the Contract.

§ 8.6 Other provisions:

§ 8.6.1 The Project Team is comprised of the Owner, Construction Manager, Owner's Representative and Architect.

§ 8.6.2 The Bid Division Description(s) outline the work items that the Contractor is responsible to provide for the Project regardless of any customary practices or agreements of that trade.

§ 8.6.3 If a Project Team member has reasonable objection to the actions of or the manner by which work is performed by a person directly employed by the Contractor or by any subcontractor of the Contractor, the Contractor shall propose another to whom the Project Team has no reasonable objection. Any cost associated with the removal and replacement of such a person shall be at the expense of the Contractor.

§ 8.6.4 All Change Orders and Change Directives will be initiated by a Change Event. (Reference Sections 01051, and 01053 of the Project Manual). The Change Event will be the instrument by which the Contractor will submit a detailed and itemized cost proposal for a proposed change for review by the Construction Manager, Owner's Representative and Architect, and the approval by the Owner, before the contract change is issued.

§ 8.6.5 A Change Event shall not alter the Contractor’s obligation to comply with the process of filing claims in accordance with other provisions of this agreement.

§ 8.6.6 All Contractors must conform to the provisions of the Michigan Right-To-Know Law, 1986 PA 80.

§ 8.6.7 All Contractors must have available on site a copy of all Safety Data Sheets and in addition provide a copy to the Construction Manager. The Construction Manager will return the copy of the Contractor’s Safety Data Sheets at the completion of the project.

§ 8.6.8 The Contractor shall include similar dispute resolution provisions in all agreements with subcontractors, sub-consultants, suppliers, or fabricators so retained, thereby providing for a consistent method of dispute resolution among the parties to those agreements.

§ 8.6.9 In the event of any inconsistency between this agreement and the General Conditions of the Contract for Construction (the “General Conditions”), the terms of this agreement shall govern.

§ 8.6.10 Claims by the Owner arising under this Agreement shall be subject to the limitations provisions defined in Michigan law, except that in no event shall a claim by the Owner be deemed untimely if filed within six (6) years of the final project completion. This provision is acknowledged to apply notwithstanding any other and shorter time frames contractually applicable to claims of the Contractor.

§ 8.6.11 The provisions of the General Conditions related to any waiver of subrogation are hereby deleted from the document and shall be deemed to have no effect. Further, any provision interpreted as the Owner waiving consequential or other indirect damages shall be ineffective and void.

§ 8.6.12 The modifications made to AIA Document A232-2019 Edition by the Owner are hereby incorporated into this Agreement.

§ 8.6.13 All specified insurance certificates and/or insurance policies must be received by the Construction Manager prior to the Contractor commencing work. The Contractor agrees to furnish a performance bond, and labor and materials payment bond for the full amount of this contract, including change orders.

ARTICLE 9 ENUMERATIONS OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A132™-2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition
- .2
- .3 AIA Document A232™-2019, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition
- .4
- .5 The Drawings are as follows, and are dated [«Drawings_Dates»](#) unless a different date is shown below: See Attachment “C”

Number	Title	Date
--------	-------	------

- .6 The Specifications are those contained in the Project Manual dated [«Manual_Dated»](#) unless a different date is shown below: See Attachment “B”

Section	Title	Date	Pages
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- .7 The Addenda, if any:

Number	Date	Pages
<u>«Addendum 1»</u>	<u>«Adm Date»</u>	

«Addendum 2» «Adm 2 Date»
«Addendum 3» «Adm 3 Date»

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

- .8 Other Exhibits:**
Supplementary and other Conditions of the Contract: Those contained in the Project Manual dated «Manual Dated» unless a different date is shown below: See Attachment “B”

Document	Title	Date	Pages
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- .9 Other documents, if any listed below:**
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A232-2019 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor’s bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Pre Bid Meeting and Agenda, Post Bid Interview Form, and Pre Construction Meeting and Agenda

This Agreement is entered into the day and year first written above.

OWNER
«Owner Name»

CONTRACTOR
«Contractor Name»

(Signature)

(Signature)

«Owner Contact and Title»
(Printed name and title)

(Printed name and title)

(Date)

(Date)

PART 1 – GENERAL

1.01 BID BONDS

- A. Bid Security must be in the form of a Bid Bond or a certified-check made payable to the Owner.
- B. When a Bid Bond is submitted, the Owner shall be listed as obligee.
- C. When a Bid Bond is submitted, the attorney-in-fact that executes the bond on behalf of the Surety shall attach to the Bond a certified, current copy of their Power of Attorney.
- D. **THE BID BOND AND ALL OTHER BONDS MUST BE ISSUED BY A SURETY COMPANY LICENSED AS SUCH TO DO BUSINESS IN THE STATE OF MICHIGAN.**

1.02 LABOR & MATERIAL PAYMENT BONDS AND PERFORMANCE BONDS

- A. The Owner reserves the right to require any successful Bidder to furnish both a Labor and Material Payment Bond, and a Performance Bond, each in the amount of one hundred percent (100%) of their contract amount.
- B. **THE LABOR & MATERIAL PAYMENT BOND AND THE PERFORMANCE BOND MUST BE ISSUED BY A SURETY COMPANY LICENSED AS SUCH TO DO BUSINESS IN THE STATE OF MICHIGAN.**
- C. When required, Labor and Material Payment Bonds and Performance Bonds must be separate. The combined form will not be accepted. Labor & Material Payment Bonds and Performance Bonds must be submitted on AIA Document A312, 2010 edition, without modifications.
- D. When submitted, Labor and Material Payment Bonds and Performance Bonds shall include:
 - 1. Full name and address of Contractor Surety and Owner.
 - 2. The proper Contract Date.
 - 3. The exact amount of the Contract.
 - 4. A description of the contract work / project.
 - 5. The Owner's name and address.
 - 6. An incorporation by reference of the contract terms.
 - 7. Language obligating the Surety, jointly and severally, with the Contract to the Owner
 - 8. The condition for discharge to the Surety.
 - 9. Signature.
 - 10. Corporate Seal, if applicable.
 - 11. Notarization.
 - 12. Power of Attorney.

1.03 SUPPLY BONDS

- A. The Owner reserves the right to require any direct supplier to furnish a Supply Bond in the amount of one hundred percent (100%) of their contract amount.
- B. Supply Bonds shall include all information required above (reference 1.02C above) for Labor and Material Payment Bonds and Performance Bonds.
- C. **ALL SUPPLY BONDS SHALL BE LEGAL AND ENFORCEABLE IN THE STATE OF MICHIGAN.**

1.04 BOND COSTS IN BIDS

- A. Do not include costs for Labor and Material Payment Bond(s), Performance Bond(s), or Supply Bond(s) in Base bid. State the cost of such Bond(s) separately, in the space(s) provided on the Proposal Form (Section 00300).

1.05 SUBMISSION OF BONDS

- A. Bonds shall be submitted to the Construction Manager for delivery to the Owner within fifteen (15) days following the date of issue of the Contract.
- B. Bonds must be submitted prior to contract execution and accepted by the Owner before work may begin on-site.
- C. If the work is commenced prior to contract execution in response to a Notice to Proceed (reference Section 00500), the Contractor shall, prior to commencement of the work, submit evidence satisfactory to the Owner that required bonds will be furnished, and shall deliver the Bonds by the date the Bidder executes the Owner/Contractor Agreement (reference Section 00510).

END OF SECTION 00600

PART 1 – GENERAL

1.01 INSURANCE CERTIFICATES

- A. Each Contractor shall provide, prior to beginning of Work, a certificate of insurance for delivery to the Owner indicating that all required insurance coverage is in force.
- B. Use standard Insurance Certificate Form. The Accord Form 25 (2016/03) are preferable forms. These forms should be obtained from your Insurance agent.
- C. Issue all certificates to: **Hemlock Public Schools**
200 Wilson St
Hemlock, MI 48626
- D. Certificates must show as ‘additional insured’ the Owner, **Hemlock Public Schools**, the Architect, **Tower Pinkster**, and the Construction Manager, **WOLGAST CORPORATION**.
- E. A “Letter of Compliance” must be completed and submitted along with the certificate of insurance. The “Letter of Compliance” form is Page 3 of this section.
- F. **Insurance certificates must be completed as follows: (please refer to corresponding numerals on the sample certificate (following instructions) and also reference the “Section 00700 - General Conditions of the Contract for Construction.”**
1. This blank is to be dated the date the certificate of insurance is issued.
 2. This blank is to provide the complete name and address of the insurance agency issuing the certificate.
 3. This blank is to provide the full name and address of the “prime contractor.”
 4. These blanks are to provide the name (or names) of the insurance company (ies) providing coverage for the specific coverage issued on the certificate.
 5. General Liability
 - a. General Liability – All blanks must be checked in this section and policies must be on an “occurrence” basis.
 - b. Policy Number – A policy number must be listed here.
 - c. Policy “effective” and “expiration” dates must be listed in these two blanks.
 - d. This section must be filled in with dollar amounts (listed in thousands). Please refer to the example on the following page.
 6. Automobile liability
 - a. These blanks must be filled in with either:
Option 1: Any Auto, Hired, and Non-Owned automobiles OR
Option 2: All Owned Autos (Priv. Pass.), All Owned Autos (Other than Priv. Pass.), Hired Autos, and Non-Owned Autos.
 - b. Policy Number – A policy number must be listed here.
 - c. Policy Effective and Expiration dates must be listed in these two blanks.
 - d. This Section must be filled in with dollar amounts (in thousands).
 7. Excess Liability (Provide \$2 million Excess Liability Umbrella policy):
 - a. This blank must be checked with the “Umbrella Form.”
 - b. Policy Number – A policy number must be listed here.
 - c. Policy Effective and Expiration dates must be listed in these blanks.
 - d. If this section is required (see Item 7 above), both of these blanks must be filled in with a minimum of \$2,000,000 and \$2,000,000.

8. Worker's Compensation
 - a. Nothing needs to be checked here.
 - b. Policy Number – A policy number must be listed here.
 - c. Policy Effective and Expiration dates must be listed in these blanks.
 - d. These blanks must be filled in with minimum limits as follows:
 - \$500,000 (each accident)
 - \$500,000 (disease policy limits)
 - \$500,000 (disease each employee)
9. This section need not be completed unless some unique coverage is required for a certain type of job.
10. This section should contain the listing of the additional insured as in 1.01D. The names of the Owner, Architect, and Construction Manager must be listed here.
11. The Owner should be listed here, as this is the actual Certificate Holder. List the Owner as follows:

Hemlock Public Schools

12. This blank must show the number thirty (30), indicating that the Owner and all additional insured parties will receive at least thirty (30) days' notice of cancellation of any of the policies listed on the certificate.
13. The certificate must be signed by a licensed insurance agent or representative of the insurance company in order to be valid.

NOTE: Sample Certificate of Liability and Letter of Compliance follows.

Letter of Compliance

Owner: _____

Contractor: _____

Project: _____

This letter is to acknowledge that I/We am/are the Insurance Agent(s) for the above named Contractor and furthermore, that we have reviewed the insurance coverage required under this Contract with the Owner:

Hemlock Public Schools

We hereby certify that said Contractor is in compliance with all insurance coverage required under this Contract with the Owner referenced above.

We hereby certify that said Contractor is in compliance with all insurance requirements, whether or not so evidenced on the attached certificate of insurance.

Signed: _____

Agency: _____

Address: _____

Agent: _____

Witness: _____

Date: _____

Notary: _____

My Commission Expires: _____

For: _____

Contractor: _____

Address: _____

Bid Division: _____



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)
(1)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER (2)	CONTACT NAME:	
	PHONE (A/C, No, Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	
	INSURER A: (4)	NAIC #
INSURED (3)	INSURER B:	
	INSURER C:	
	INSURER D:	
	INSURER E:	
	INSURER F:	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL/SUBR INSD WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
<input checked="" type="checkbox"/>	COMMERCIAL GENERAL LIABILITY (5A) <input type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> OCCUR		(5B)	(5C)		EACH OCCURRENCE (5D) \$ 1,000,000.00 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 100,000.00 MED EXP (Any one person) \$ 5,000.00 PERSONAL & ADV INJURY \$ 1,000,000.00 GENERAL AGGREGATE \$ 1,000,000.00 PRODUCTS - COMP/OP AGG \$ 1,000,000.00
<input checked="" type="checkbox"/>	AUTOMOBILE LIABILITY (6A) <input checked="" type="checkbox"/> ANY AUTO OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> HIRED AUTOS ONLY <input checked="" type="checkbox"/> NON-OWNED AUTOS ONLY		(6B)	(6C)		COMBINED SINGLE LIMIT (Ea accident) (6D) \$ 1,000,000.00 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$
<input checked="" type="checkbox"/>	UMBRELLA LIAB <input type="checkbox"/> OCCUR (7A) EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE		(7B)	(7C)		EACH OCCURRENCE (7D) \$ 2,000,000.00 AGGREGATE \$ 2,000,000.00
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY (8A) ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	<input type="checkbox"/> Y/N <input type="checkbox"/> N/A	(8B)	(8C)		PER STATUTE OTH-ER (8D) E.L. EACH ACCIDENT \$ 500,000.00 E.L. DISEASE - EA EMPLOYEE \$ 500,000.00 E.L. DISEASE - POLICY LIMIT \$ 500,000.00
(9)						

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

(10) LIST THE OWNER, ARCHITECT AND CONSTRUCTION MANAGER AS ADDITIONAL INSURED

CERTIFICATE HOLDER	CANCELLATION
(11) INSERT THE OWNER'S NAME HERE NOTE: PLEASE HAVE YOUR INSURANCE COMPANY MAIL THIS DOCUMENT TO THE CONSTRUCTION MANAGER	(12) SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
	AUTHORIZED REPRESENTATIVE (13)

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ACORD 25 (2016/03)

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED - OWNERS, LESSEES OR
CONTRACTORS - SCHEDULED PERSON OR ORGANIZATION**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s)	Location(s) Of Covered Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. Section II - Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

However:

1. The insurance afforded to such additional insured only applies to the extent permitted by law; and
2. If coverage provided to the additional insured is required by a contract or agreement, the insurance afforded to such additional insured will not be broader than that which you are required by the contract or agreement to provide for such additional insured.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

C. With respect to the insurance afforded to these additional insureds, the following is added to **Section III - Limits Of Insurance**:

If coverage provided to the additional insured is required by a contract or agreement, the most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the contract or agreement; or
2. Available under the applicable Limits of Insurance shown in the Declarations;

whichever is less.

This endorsement shall not increase the applicable Limits of Insurance shown in the Declarations.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED - OWNERS, LESSEES OR
CONTRACTORS - AUTOMATIC STATUS WHEN
REQUIRED IN CONSTRUCTION AGREEMENT WITH YOU**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

A. Section II - Who Is An Insured is amended to include as an additional insured any person or organization for whom you are performing operations when you and such person or organization have agreed in writing in a contract or agreement that such person or organization be added as an additional insured on your policy. Such person or organization is an additional insured only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured.

However, the insurance afforded to such additional insured:

1. Only applies to the extent permitted by law; and
2. Will not be broader than that which you are required by the contract or agreement to provide for such additional insured.

A person's or organization's status as an additional insured under this endorsement ends when your operations for that additional insured are completed.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to:

1. "Bodily injury", "property damage" or "personal and advertising injury" arising out of the rendering of, or the failure to render, any professional architectural, engineering or surveying services, including:

- a. The preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or
- b. Supervisory, inspection, architectural or engineering activities.

This exclusion applies even if the claims against any insured allege negligence or other wrongdoing in the supervision, hiring, employment, training or monitoring of others by that insured, if the "occurrence" which caused the "bodily injury" or "property damage", or the offense which caused the "personal and advertising injury", involved the rendering of or the failure to render any professional architectural, engineering or surveying services.

2. "Bodily injury" or "property damage" occurring after:

- a. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
- b. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as part of the same project.

C. With respect to the insurance afforded to these additional insureds, the following is added to **Section III - Limits Of Insurance**:

The most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the contract or agreement you have entered into with the additional insured; or
2. Available under the applicable Limits of Insurance shown in the Declarations;

whichever is less.

This endorsement shall not increase the applicable Limits of Insurance shown in the Declarations.

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED - OWNERS, LESSEES OR
CONTRACTORS - COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s)	Location(s) And Description Of Covered Operations

Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

A. Section II - Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

However:

1. The insurance afforded to such additional insured only applies to the extent permitted by law; and
2. If coverage provided to the additional insured is required by a contract or agreement, the insurance afforded to such additional insured will not be broader than that which you are required by the

contract or agreement to provide for such additional insured.

B. With respect to the insurance afforded to these additional insureds, the following is added to Section III - Limits Of Insurance:

If coverage provided to the additional insured is required by a contract or agreement, the most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the contract or agreement; or
2. Available under the applicable Limits of Insurance shown in the Declarations;

whichever is less.

This endorsement shall not increase the applicable Limits of Insurance shown in the Declarations.

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Within fifteen (15) days following the date of the issue of the Notice to Proceed (Section 00500), each Contractor shall submit to the Construction Manager for delivery to the Owner, a Schedule of Values showing accurate costs for the elements of their Work.
- B. The Schedule of Values shall be typed or printed on Contractor's letterhead, identify the project and work division, and must be dated and signed.
- C. The Schedule of Values shall divide the Work into a sufficient number of individual cost elements to serve as an accurate basis for Contractor's Application for Payment.
- D. Each work element shall be listed identifying labor and material as separate line items. Each work element shall include its prorated share of profit, overhead, and retainage.

1.02 SPECIAL ITEMS

- A. As a part of the schedule of values the Contractor shall designate specific line items and associated values identified as:
 - 1. Performance Bond and Labor & Material Payment Bond (when required by Owner).
Value: Actual Cost of Bonds
 - 2. Daily housekeeping and clean-up inclusive of any special cleaning and preparation required by the specification for delivering the building for the Owners occupancy.
Value: Two percent (2%) of the total Contract Amount
 - 3. Retainage / Punch List
Value: Ten percent (10%) of the total Contract Amount
- B. A request for payment of any special item amount contained in the Contractor's approved Schedule of Values or a portion thereof may be submitted for payment once the work for that item has been completed to the satisfaction of the Owner, Architect and Construction Manager
- C. Upon the completion of the Contractor's work exclusive of any punch list work, a Contractor may submit a separate Application for Payment requesting the Retention / Punch List line item be reduced to (5%). **This** request must be submitted to the Construction Manager along with a Partial Consent of Surety. Once received, the Construction Manager will forward to the Owner for approval and notify the contractor when fully executed. The Owner shall reserve the right to accept or reject all requests for Retention / Punch List reduction.
- D. The Schedule of Values shall be submitted and approved prior to Contract execution and receipt of any payment.
- E. **Absolutely NO CHANGES may be made to an approved Schedule of Values.**
- F. Increases or decreases in the Contract Amount shall be through change orders.
- G. Each Change Order shall be listed as a new line item on the Contractor Invoicing Form.

END OF SECTION 00670

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Within fifteen (15) days following the date of the issue of the Contract, each Contractor shall submit to the Construction Manager for delivery to the Owner, a list of all subcontractors that they intend to utilize in their performance of the Work, and all suppliers who will be providing materials and/or equipment to be incorporated into the Work.
- B. All SUBCONTRACTORS' names, addresses, telephone numbers, and types of Work shall be included on the list.
- C. All SUPPLIERS' names, addresses, telephone number, and items provided shall be included on the list.
- D. All items of material and equipment include in the Work shall be listed. Each items shall be listed with its manufacturer, supplier, and installing subcontractor, if applicable.
- E. Subcontractor / Supplier / Material / Equipment listings shall be submitted prior to contract execution.
- F. Prior to award of a contract, the Construction Manager will notify the contractor if the Owner has reasonable and substantial objection to any person, organization, material and/or equipment listed by the Contractor. If the Owner has a reasonable and substantial objection, the Contractor shall amend their Proposal by providing an acceptable substitute. The Owner may, at their discretion, accept such a substitute or they may disqualify the Proposal.
- G. **Suppliers, Subcontractors, Material, and Equipment proposed by the Contractor and accepted by the Owner shall be used in the Work for which they are proposed and accepted, and shall not be changed except with prior written approval by the Construction Manager and Owner.**

END OF SECTION 00680

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Within fifteen (15) days following the date of issue of a Contract, each Contractor shall submit to the Construction Manager, for delivery to the Owner, a list of all supervisory employees whom the Contractor proposes to employ to accomplish the Work
- B. This list shall include supervisory employees' names, titles, and duties.
- C. Employee listings shall be submitted prior to contract execution.

1.02 OWNER'S APPROVAL

- A. Contractors are required to establish, to the satisfaction of the Owner, the reliability and responsibility of proposed employees.
- B. Prior to the award of a contract, the Construction Manager will notify the Contractor if the Owner has reasonable and substantial objection to any person listed by the Contractor. If the Owner has reasonable and substantial objection, the Contractor may amend their Proposal by providing an acceptable substitute. The Owner may, at their discretion, accept such a substitute or they may disqualify the Proposal.
- C. Employees proposed by the Contractor and accepted by the Owner shall be employed on the Work for which they are proposed and accepted, and shall not be changed except with written approval of the Owner.

END OF SECTION 00690

**PROJECT
GENERAL CONDITIONS
OF THE CONTRACT FOR
CONSTRUCTION ON
FOLLOWING PAGE(S)**

END OF SECTION 00700



AIA® Document A232™ – 2019

General Conditions of the Contract for Construction, Construction Manager as Adviser Edition

for the following PROJECT:

(Name, and location or address)

Hemlock Public School District, 2022 School Bond Construction Program – including erecting, furnishing and equipping additions to school buildings; remodeling, furnishing and refurbishing and equipping and re-equipping school buildings; acquiring, installing and equipping or re-equipping school buildings for instructional technology; and preparing, developing, improving and equipping playgrounds, play fields, athletic fields and facilities and sites; all in accordance with the relevant application for preliminary qualification of bonds, the approved project scopes, applicable laws, the applicable plans and specifications, the Owner’s fixed budget, and as otherwise approved by the Owner.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Documents A132™–2019, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2019, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2019, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

THE CONSTRUCTION MANAGER:

(Name, legal status, and address)

Wolgast Corporation
4835 Towne Centre Road, Suite 203
Saginaw, Michigan 48604
Telephone: (989) 790-9120
Facsimile: (989) 790-9063

THE OWNER:

(Name, legal status, and address)

Hemlock Public School District
200 Wilson Street / P.O. Box 260
Hemlock, Michigan 48626
Telephone: (989) 642-5282
Facsimile: (989) 642-2773

THE ARCHITECT:

(Name, legal status, and address)

TowerPinkster
4 East Fulton Street
Grand Rapids, Michigan 49503
Telephone: (616) 456-9944

TABLE OF ARTICLES

1	GENERAL PROVISIONS
2	OWNER
3	CONTRACTOR
4	ARCHITECT AND CONSTRUCTION MANAGER
5	SUBCONTRACTORS
6	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7	CHANGES IN THE WORK
8	TIME
9	PAYMENTS AND COMPLETION
10	PROTECTION OF PERSONS AND PROPERTY
11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS
14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 **The Contract Documents.** The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, as to contractors, the Contract Documents do not also include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, Owner-accepted portions of the Contractor's bid or proposal, or and portions of addenda relating to bidding or proposal requirements but do not include sample forms. The Architect's execution of the Owner/Architect Agreement and the Construction Manager's execution of the Owner/Construction Manager Agreement shall constitute their acceptance of all terms herein related to the respective parties.

§ 1.1.2 **The Contract.** The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

§ 1.1.3 **The Work.** The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project. The Contractor acknowledges and agrees that the Contract Documents are sufficient to provide for the completion of the Work and that the Contract Documents include work (whether or not shown or described) which reasonably may be inferred to be required or useful for the completion of the Work in accordance with applicable laws, codes, and customary standards of the construction industry.

§ 1.1.4 **The Project.** The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors, and by the Owner's own forces and Separate Contractors.

§ 1.1.5 **Contractors.** Contractors are persons or entities, other than the Contractor or Separate Contractors, who perform Work under contracts with the Owner that are administered by the Architect and Construction Manager.

§ 1.1.6 **Separate Contractors.** Separate Contractors are persons or entities who perform construction under separate contracts with the Owner not administered by the Architect and Construction Manager.

§ 1.1.7 **The Drawings.** The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.8 **The Specifications.** The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.9 **Instruments of Service.** Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.10 Initial Decision Maker. The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not ~~show partiality to the Owner or Contractor and shall not~~ be liable for results of interpretations or decisions rendered in good ~~faith~~ faith and without negligence.

§ 1.1.11 Products. The term "Product(s)" as used in the Contract Documents refers to the materials, systems, and equipment provided by the Contractor for use in the Work of the Project.

§ 1.1.12 Warranty. The terms "Warranty" and "Guarantee" as used in the Contract Documents shall have the same meaning and shall be defined as "legally enforceable assurance of satisfactory performance or quality of a product or Work".

§ 1.1.13 Materials. Where materials, systems, and equipment items are referred to in the singular, such reference shall not serve to limit the quantity required. The Contractor shall furnish quantities as required by the Contract Documents to complete the Work. Unless specifically limited in the Contract Documents, the words "furnish", "install", and "provide", or any combination thereof mean to furnish and incorporate into the Work, including all necessary labor, materials, and equipment and other items required to perform the Work indicated.

§ 1.1.14 Project Manual. The Project Manual is a volume assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract, and Specifications.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where responsibility for particular Work is required of the Contractor, the Contractor shall not be released from that responsibility by reason of the specification or drawing which establishes the responsibility. Thus, the Contractor shall be responsible for all Work required of it, even though that responsibility may be shown only in that portion of the documents typically pertaining to another contractor or trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 If there should be a conflict between two or more of the Contract Documents then the following order of interpretation shall apply:

- .1 Where requirements specifically set forth in the applicable Agreement are in conflict with other Contract Documents, including but not limited to these General Conditions, the Agreement shall govern.
- .2 In all other instances, the conflict shall be resolved by complying with the provision that is most favorable to the Owner (as determined by the Owner in the Owner's sole discretion).
- .3 When a duplicate of material or equipment occurs in the Drawings, the Specifications or other Contract Documents, each Contractor shall be deemed to have bid on the basis of each furnishing such material or equipment. The Owner, with the assistance of the Architect and Construction Manager, will decide which Subcontractor(s) shall furnish the same.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

~~§ 1.5.1~~ ~~The~~ ~~Unless~~ ~~otherwise~~ ~~indicated~~ ~~in~~ ~~the~~ ~~Contract~~ ~~Documents~~ ~~or~~ ~~the~~ ~~Owner/Architect~~ ~~Agreement~~, ~~the~~ ~~Architect~~ and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and unless otherwise indicated in the Contract Documents or the Owner/Architect Agreement, the Architect and respective consultants will retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by national overnight courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement. Further, any other written notice delivered with a written acknowledgement or receipt shall be deemed duly served, regardless of method.

Wherever the Contract Documents require the Contractor to give "Notice" or "Timely Notice" to the Architect, Public Authority, and/or others, it shall be the Contractor's responsibility to furnish all such notices sufficiently in advance to allow the party receiving the notice reasonable time to react to such notice, including travel time on the job site as necessary, when such notices require the on-site presence of the Architect, Public Authority, their authorized representatives, or others for field observation of inspections, testing or approvals. Reasonable time shall be defined as no less than 24 hours plus normal travel time from the home office of the party being notified to the job site and must also accommodate known, standard, or reasonable processing periods.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties ~~shall~~ may agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties ~~will~~ may use AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

~~§ 1.8 Building Information Models Use and Reliance~~

~~Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA~~

Init.

Document E203™ 2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™ 2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or ~~authorization~~ authorization subject to parameters of authority established by Owner's board of education. Except as otherwise provided in Section 4.2.1, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

~~§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.~~

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work, and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

~~§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as Owner's information is "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.~~

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, ~~including including, but not limited to,~~ those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, assisted by the Construction Manager, shall secure and pay for the building permit.

§ 2.3.2 The ~~Owner shall retain an architect~~ Architect is the person lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project ~~is located~~ is located, if licensed architecture is required by law for the Project. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect," "Architect/Engineer," "Engineer," or "Design Professional" as used herein means the Architect or the Architect's authorized representative.

§ 2.3.3 The ~~Owner shall retain a~~ construction manager adviser is lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.4 If the employment of the Construction Manager or Architect terminates, the Owner shall employ a successor construction manager or architect ~~to whom the Contractor has no reasonable objection and~~ whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 2.3.5 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. ~~The Taking into account the Contractor's experience and expertise, and exercise of professional caution, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work. The Contractor shall not be entitled to additional compensation resulting from its failure to confirm the location of the site utilities or existing structures prior to bid opening.~~

§ 2.3.6 ~~The~~ Upon specific written request of the Contractor, the Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services. Contracts with other Contractors alone shall not constitute sufficient Owner control for purposes of this section.

§ 2.3.7 Unless otherwise provided in the Contract Documents, the ~~Owner shall furnish to the Contractor~~ Contractor will receive at least one copy of the Contract Documents in pdf format (or another format reasonably approved by the Owner) for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3.8 The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager. Other communication shall be made as set forth in Section 4.2.6.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or ~~repeatedly~~ fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3. This right shall be in addition to and not in limitation of the Owner's rights under any provision of the Contract Documents.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ~~ten-day~~ three-day period after receipt of notice from the Owner or the Owner's designee (or immediately in the case of a threat to the safety of persons or property) to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, ~~correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to review by the Construction Manager and prior approval of the Architect, and the Construction Manager or Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the including any claim against the Contractor's Performance Bond, correct such default or neglect. In such case, the Owner may deduct from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses, including any and all legal expenses incurred to effectuate and enforce this provision and compensation for the Construction Manager's and Architect's and their~~

respective consultants' additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

If the Architect, Construction Manager, Owner, or other contractors or consultants are required to provide additional services due to defects or deficiencies in the Contractor's work or by failure of the Contractor to perform under its agreement, the Contractor shall be responsible for all such costs and fees (including attorney fees), which shall promptly be paid to the Owner. The Owner, Contractor, Architect, and Construction Manager acknowledge that the Owner's receipt of such payment from the Contractor is a condition precedent to the Owner's obligation to make payment to those adversely affected.

This Section 2.5 allows the Owner to withhold payments from a non-performing Contractor irrespective of the termination procedure identified in Section 14.2, and the Owner may pursue either remedy, or both.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.1.1 Possession, sale, or consumption of alcoholic beverages on the construction site is strictly prohibited. The unlawful manufacture, distribution, dispensation, possession or use of drugs is prohibited on the construction site.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.5, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of

Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.5 Prior to submitting its bid, the Contractor shall have studied and compared the Contract Documents and shall have reported to the Architect any error, inconsistency, or omission in the Contract Documents related to its work. It will be presumed that the Contractor's bid and the Contract Sum include the cost of correcting any error, inconsistency, or omission, which could have been discovered by the exercise of reasonable diligence. Unless the Contractor establishes that such error, inconsistency, or omission could not have been discovered by the exercise of reasonable diligence, the Contractor will make such corrections without additional compensation so that the Work is fully functional.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner, the Construction Manager, and the Architect, and shall propose alternative means, methods, techniques, sequences, or ~~procedures, procedures,~~ specifically including any delays that could impact timely coordination and completion of the Work. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. The Construction Manager shall review the proposed alternative for sequencing, constructability, and coordination impacts on the other Contractors. Unless the Architect or the Construction Manager objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures. The Contractor shall immediately notify the Construction Manager of delays of other contractors that could impact timely coordination and completion of the Work.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Such provision of labor and materials shall occur in sufficient time to satisfy the existing Project schedule. The Contractor bears the risk of any failure to timely provide such labor and materials for any reason. The Contractor agrees to execute the appropriate UCC forms to effectuate the Owner's ownership of the material and equipment furnished pursuant to this Agreement.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 The Contractor, Construction Manager, and Architect each respectively agree that neither they nor their subcontractors will discriminate against any employee or applicant for employment, to be employed in the performance of this contract, with respect to hire, tenure, conditions or privilege of employment, or any matter directly or indirectly related to employment, because of race, age, sex, color, religion, national origin, ancestry or physical disability. Breach of this covenant may be regarded as a material breach of this contract.

§ 3.4.5 Asbestos-Free Product Installation

§ 3.4.5.1 It is hereby understood and agreed that no product and/or material containing asbestos including chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos and any combination of these materials that have been chemically treated and/or altered shall be installed or introduced into the Work by the contractor or his employees, agents, subcontractors, or other individuals or entities over whom the Contractor has control. If applicable, the Contractor shall be required to provide a signed certification statement ensuring that all products or materials installed or introduced into the work all be asbestos-free.

§ 3.4.5.2 The Contractor shall also be required to furnish certified statements from the manufacturers of supplied materials used during construction verifying their products to be asbestos-free in accordance with the requirements of Section 3.4.5.1.

§ 3.4.5.3 The Contractor shall complete and submit to the Owner a certification evidencing asbestos-free product installation prior to issuance of the final Certificate for Payment, in a form acceptable to the Owner.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract in addition to any other warranties, guarantees or obligations set forth in the Contract Documents or applicable as a matter of a law and not in limitation of the terms of the Contract Documents, the Contractor warrants and guarantees that:

- .1 The Owner will have good title to the Work and all materials and equipment incorporated into the Work and, unless otherwise expressly provided in the Contract Documents, will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. new;
2. The Work and all materials and equipment incorporated into the Work will be free from all defects, including any defects in workmanship or materials;
3. The Work and all equipment incorporated into the Work will be fit for the purpose for which they are intended;
4. The Work and all materials and equipment incorporated into the Work will be merchantable; and
5. The Work and all materials and equipment incorporated into the Work will conform in all respects to the Contract Documents.

If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

Upon notice of the breach of any of the foregoing warranties or guarantees or any other warranties or guarantees under the Contract Documents, the Contractor, in addition to any other requirements in the Contract Documents, will commence to correct such breach within seventy-two (72) hours after written notice thereof and thereafter will use its best efforts to correct such breach to the satisfaction of the Owner; provided that if such notice is given after final payment hereunder, such seventy-two (72) hour period shall be extended to seven (7) days. The foregoing warranties and obligations of the Contractor shall survive the final payment and/or termination of the Contract.

The Contractor shall, at the time of final completion of the Work and as a condition precedent to final payment to the Contractor, assign to the Owner all manufacturers' warranties related to the materials and labor used in the Work. The Contractor further agrees to perform the Work in such manner as to preserve any and all such manufacturers'

warranties and deliver to the Owner the warranties, project manuals, operating procedures, and other materials related to each of the building systems and materials included in the Contractor's Work and as required by the Specifications.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor shall also pay all state and federal taxes levied on its business, income or property and shall make all contributions for social security and other wage or payroll taxes. The Contractor shall be solely responsible for such payments and shall hold the Owner harmless from same.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, assisted by the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work ~~knowing it to be~~ contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide written and dated notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect and Construction Manager will promptly investigate such conditions and, ~~if the Owner and the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, they will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Owner and the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may~~ the Contractor shall submit a Claim as provided in Article 15. The requirements of Section 2 of 1998 PA 57 (MCL 125.1592), as amended, are hereby incorporated into this document. The Contractor shall be alert to any indication or evidence of existing underground or concealed utilities or structures not shown on the Contract Documents and shall immediately notify the Owner of discovery of such evidence. If the Contractor encounters such utilities or structures, it shall cease operations immediately to minimize damage and shall notify the Owner and Architect. The Contractor shall bear the cost of damage resulting from its failure to exercise reasonable care in its construction activity or from continuing operations without notifying the Owner.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall ~~notify~~ provide written and dated notification to the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features ~~may be made~~ shall be made, as needed as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are ~~more than or~~ less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. The superintendent and any other personnel shall be satisfactory to the Owner in all respects, and the Owner shall have the right to require the Contractor to remove any superintendent or any other personnel from the Project whose performance is not satisfactory to the Owner and to replace such superintendent or other personnel with another who is satisfactory to the Owner.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect, through the Construction Manager, of the name and qualifications of a proposed superintendent. ~~Within The Owner and/or the Construction Manager may replay within 14 days of receipt of the information, the Construction Manager may notify the Contractor, stating whether the Owner, the Construction Manager, or the Architect (1) has reasonable objection to the proposed superintendent or (2) require additional time for review. Failure of the Construction Manager to provide notice within the 14 day period shall constitute notice of no reasonable objection.~~

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager, or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's ~~consent, which shall not unreasonably be withheld or delayed.~~ consent.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information, and the Construction Manager's use in developing the Project schedule, a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. In no event shall the Contractor's Construction Schedule be extended due to action or inaction of the Contractor, except with prior written approval of the Owner within the Owner's sole discretion. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project. The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Contractors, or the construction or operations of the Owner's own forces or Separate Contractors.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the ~~Owner's, Construction Manager's and Architect's approval. The Architect and Construction Manager's approval which~~ approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, ~~and~~ (2) allow the Construction Manager and Architect reasonable time to review ~~submittals, submittals, and~~ (3) provide for expeditious and practical execution of the Work. If the Contractor fails to submit a submittal schedule, or fails to

provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager, and the Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in ~~general accordance with the most recent schedules submitted to the Owner, Construction Manager, and Architect, and incorporated into the approved Project schedule~~ accordance with the most recent approved project schedule and the most recent work schedule.

§ 3.10.5 The Contractor shall cooperate with the Construction Manager in scheduling and performing its Work to avoid conflict or interference with the Work of others, and the Contractor shall be responsible for any conflict or interferences that it causes. The Construction Manager and the Contractor acknowledge and understand that the work schedule will be modified from time-to-time with the Owner's approval to coordinate with the work of others and that such schedule changes do not give rise to a claim for damages or additional compensation by the Contractor for delay or otherwise. The Contractor shall be required to conform to the most recent Owner-approved schedule and acknowledges that fact was taken into account when it agreed to the Contract Sum and entered into this Contract.

§ 3.10.6 The Contractor shall cooperate with the Construction Manager in working out and following the proper sequence of operations between the Work of the Contractor and that of other trades on the site.

§ 3.10.7 The Contractor shall prosecute the Work undertaken in a prompt and diligent manner whenever the Work (or a part thereof) becomes available, or at such other time as the Owner and/or Construction Manager may direct so as to promote the general progress of the entire construction. The Contractor shall not, by delay or otherwise, interfere with or hinder the Work of the Construction Manager or any other Contractor. Any materials that are to be furnished by the Contractor shall be furnished in sufficient time to enable the Contractor to perform and complete its Work within the time or times provided in the schedule. If the Contractor shall, through its action or inactions, including the actions or inactions of its' subcontractors or suppliers, fall behind in furnishing necessary labor and/or materials to meet the construction needs in accordance with the established schedule, then it shall increase its forces or work such overtime as may be required, at its own expense, to bring its part of the work up to the proper schedule. In the event that the Contractor does not take such action necessary to bring its part of the work up to schedule, as determined by the Construction Manager, then the Owner may supplement the Contractor's forces or take other action permitted under Section 2.4 or Section 2.5. The Contractor shall be responsible for any and all costs of performing or completing the Work and shall pay any such sums within ten (10) days of an invoice. If not paid within ten (10) days, the amount will be withheld from the Contractor's next payment and paid to the relevant parties. If the amounts withheld from payments then or thereafter due Contractor are insufficient to cover such costs, the Owner may bill these costs to the Contractor, and the Contractor shall pay any such sums within ten (10) days of an invoice. Exercise of such rights shall in no way limit or jeopardize the Owner's right to any other remedy, including but not limited to a claim against the Performance Bond of the Contractor.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Construction Manager, Architect, and Owner, and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data, and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor for submittal to and review by the Architect to illustrate materials or equipment for some portion of the Work. All Work shall be furnished and installed in accordance with the Drawings,

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Specifications and as additionally required by the manufacturer's printed instructions. The Contractor shall review the manufacturer's instructions, and where conflict occurs between the Drawings or Specifications and the manufacturer's instructions, the Contractor shall request clarification from the Architect prior to commencing the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.10 through 4.2.12. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Construction Manager, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the Project submittal schedule approved by the Construction Manager and Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Contractors, Separate Contractors, or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples, and similar submittals with related documents submitted by other Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been reviewed and approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's review and approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Construction Manager and Architect in a detailed writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to reasonably rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. ~~Documents, subject to its experience and expertise.~~ The Contractor shall cause such services or

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certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. ~~The Owner, the Architect, and the Owner shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals.~~ The Architect and Construction Manager shall be entitled to reasonably rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, ~~provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy, subject to their professional judgment, experience, and expertise.~~ Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Construction Manager shall review submittals for sequencing, constructability, and coordination impacts on other Contractors.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Construction Manager and Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, permits, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Only materials and equipment which are to be used for the Project or to carry out the Work shall be stored at the Project site(s). Protection of such materials and equipment shall be the sole responsibility of the Contractor.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner, Separate Contractors, or of other Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner, Separate Contractors, or by other Contractors except with written consent of the Construction Manager, Owner, and such other Contractors or Separate Contractors. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Separate Contractors, other Contractors, or the Owner, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor and its Subcontractors shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 Any areas and/or concurrently occupied space both occupied by the Owner and used in the progress of the Work, whether within the limits of the construction site or the adjacent areas leading to it, shall be maintained in a clean and safe condition and open to travel. Failure by the Contractor to maintain said areas will result in the Owner's cleaning of same, at the expense of the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager, and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall indemnify and hold harmless the Owner, Construction Manager, and Architect ~~harmless from~~ from any and all cost, damage, and loss on account thereof, including, but not limited to actual attorneys' fees, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner, Architect, or Construction Manager. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect through the Construction Manager. The review by the Owner of any method of construction, invention, appliance, process, article, device or materials of any kind shall be for its adequacy as integrated into the Work and shall not be an approval for the use thereof by the Contractor in violation of any patent or other rights of any third person.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or ~~resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent in any way related to performance of the Work, or the duties or obligations of this Agreement or the failure of the Contractor or the Work to conform with the Contract Documents, caused in whole or in part by any acts or omissions of the Contractor, a Subcontractor, or anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder.~~ them or anyone for whose acts of any of them may be liable. The Contractor shall not be obligated to indemnify a party for that party's sole negligence but shall remain liable to the fullest extent of its fault or the fault of a person for whom the Contractor is responsible (e.g., a Subcontractor). The Contractor shall be responsible to the Owner, Construction Manager, Architect, Architect's consultants and agents and employees of any of them from and against all amounts such parties may be required to pay in attorney fees in order to pursue enforcement of this provision against the Contractor or otherwise obtain indemnification from the Contractor provided under the terms of this Section 3.18 or any other applicable Contract Document. Such obligation shall not be construed to negate, abridge, or reduce any other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18, which would otherwise exist as to any party or person set forth in this section. To the fullest extent permitted by law, the Contractor shall indemnify the Owner and save the Owner harmless against all loss by fines, penalties or corrective measures resulting from negligent or wrongful acts or omissions by the Contractor, its Subcontractors, agents, employees or assigns, with respect to the violation of safety requirements of this Contract, including reasonable attorney fees.

§ 3.18.2 ~~In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.~~ addition to and not in limitation of the Contractor's other indemnity obligations, the Contractor hereby accepts and assumes exclusive liability for and shall indemnify and save harmless the Owner, Construction Manager and Architect from and against the payment of the following:

All contributions, taxes, or premiums (including interest and penalties thereon) which may be payable under the unemployment insurance law of any state, the federal Social Security Act, federal, state, county and/or municipal tax withholding laws, or any other law, measured upon the payroll of or required to be withheld from employees by whomsoever employed, engaged in the Work to be performed and furnished under the Contract Documents.

All sales, use, personal property and other taxes (including interest and penalties thereon) required by any federal, state, county, municipal or other law to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person or persons acting for, through or under it or any of them, by reason of the performance of the Work

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or the acquisition, ownership, furnishing, or use of any materials, equipment, supplies, labor, services or other items for or in connection with the Work;

All pension, welfare, vacation, annuity and other benefit contributions payable under or in connection with respect to all persons by whomsoever employed, engaged in the Work to be performed and furnished under the Contract Documents.

The Contractor shall indemnify and hold the Owner harmless from any claim, damage, loss or expense, including but not limited to actual attorney fees, incurred by the Owner related to any hazardous material or waste, toxic substance, pollution or contamination brought into the Project site or caused by the Contractor or used, handles, transported, stored, removed, remediated, disturbed or dispersed of by Contractor.

§ 3.18.3 In the event that any claim is made or asserted, or lawsuit filed for damages or injury arising out of or resulting from the performance of the Work, whether or not the Owner is named as a party, the Contractor shall immediately advise the Owner, in writing, of such claim or lawsuit and shall provide a full and complete copy of any documents or pleadings thereto, as well as a full and accurate report of the facts involved.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement. The term "Architect," "Architect/Engineer," "Engineer," or "Design Professional" as used herein means the Architect or the Architect's authorized representative.

§ 4.1.2 The Construction Manager is the person or entity retained by the Owner pursuant to Section 2.3.3 and identified as such in the Agreement.

§ 4.1.3 Duties, responsibilities, and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the ~~Owner, Construction Manager, Architect, and Contractor.~~ Owner and the Construction Manager or Architect, respectively. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for ~~Payment.~~ Payment and with the Owner's written concurrence during the correction period. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or more frequently, as otherwise agreed with the ~~Owner,~~ Owner or as required by law, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. ~~However,~~ Subject to the Owner/Architect Agreement, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner and the Construction Manager reasonably informed about the progress and quality of the portion of the Work completed, will guard the Owner against defects and deficiencies in the work, and promptly report to the Owner and Construction Manager known deviations from the Contract ~~Documents.~~ Documents, the Project schedule and defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner and Architect reasonably informed of the progress of the Work, and will promptly report to the Owner and Architect known deviations from the Contract Documents and the most recent Project schedule, and defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Contractors in accordance with the latest approved Project ~~schedule~~-schedule and shall supervise construction as required by 1937 PA 306 (MCL 388.851 et seq.).

§ 4.2.5 The Construction ~~Manager, Manager and Architect~~, except to the extent required by Section 4.2.4, ~~and Architect 4.2.4 or by 1937 PA 306 and/or 1980 PA 299, as applicable~~, will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the Contractor's safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract ~~Documents, and Documents~~. Except as required by their respective agreements with the Owner, neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract ~~Documents. Neither the Construction Manager nor the Architect Documents and neither~~ will have control over or charge of, or be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work. The Construction Manager will schedule and coordinate the work of all Contractors on the Project, including the Contractors' use of the site. The Construction Manager will keep the Contractors informed of the Project Construction Schedule to enable the Contractors to plan and perform the Work in a timely manner.

§ 4.2.6 **Communications.** The Owner shall endeavor to communicate with the Contractor and the Construction Manager's consultants through the Construction Manager about matters arising out of or relating to the Contract Documents. The Owner and Construction Manager shall endeavor to include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall endeavor to promptly notify the Architect of the substance of any direct communications between the Owner and the Construction Manager otherwise relating to the Project. Communications by and with the Architect's consultants ~~shall~~may be through the Architect. Communications by and with Subcontractors and suppliers ~~shall~~may be through the Contractor. Communications by and with other Contractors shall be through the Construction Manager. Communications by and with the Owner's own forces and Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents, and will notify each other about the rejection. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, upon written authorization of the Owner, whether or not the Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 Utilizing the submittal schedule provided by the Contractor, the Construction Manager shall prepare, and revise as necessary, a Project submittal schedule incorporating information from other Contractors, the Owner, Owner's consultants, Owner's Separate Contractors and vendors, governmental agencies, and participants in the Project under the management of the Construction Manager. The Project submittal schedule and any revisions shall be submitted to the Architect for approval.

§ 4.2.10 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data, and Samples. Where there are other Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from the Contractor and other Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

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§ 4.2.11 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.12 Review of the Contractor's submittals by the Construction Manager and Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. However, should the Construction Manager or Architect discover during the course of such review any inaccuracies, incompleteness, or other irregularities, they shall immediately notify the Owner of the same to determine an appropriate corrective course of action or notify the Contractor of the same to correct the irregularities.

§ 4.2.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.14 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7, and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.15 ~~Utilizing the documents provided by the Contractor, the~~ The Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples, and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner in good condition and reasonably organized upon completion of the Project.

§ 4.2.16 The Construction Manager will assist the Architect in conducting inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.17 ~~If the Owner and Architect agree, the~~ The Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Construction Manager of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.18 The Architect will interpret ~~and decide~~ matters concerning performance under, and requirements of, the Contract Documents on written request of the Construction Manager, Owner, or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.19 Interpretations ~~and decisions~~ of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such ~~interpretations and decisions, interpretations,~~ interpretations, the Architect will endeavor to secure faithful performance by ~~both Owner and Contractor, will not show partiality to either,~~ and will not be liable for results of interpretations ~~or decisions~~ so rendered in good ~~faith,~~ faith and without negligence.

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§ 4.2.20 The Architect's ~~decisions-interpretations~~ on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents. ~~Documents and acceptable to the Owner.~~

§ 4.2.21 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing, through the Construction Manager, to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable ~~promptness~~. promptness given the particular circumstances. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Contractors or Separate Contractors or the subcontractors of other Contractors or Separate Contractors. The term "Subcontractor" shall also include material and equipment suppliers.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Construction Manager, for review by the Owner, Construction Manager and Architect, of the persons or entities proposed for each principal portion of the Work, including those who are to furnish supplies, materials or equipment. ~~equipment, including those~~ fabricated to a special design. Within 14 days of receipt of the information, the Construction Manager ~~may will~~ notify the Contractor whether the Owner, the Construction Manager or the Architect (1) has reasonable objection to any such proposed person or entity or, (2) requires additional time for review. ~~Failure of the Construction Manager to provide notice within the 14 day period shall constitute notice of no reasonable objection.~~ The Contractor shall remain, in all instances, jointly and severally liable to the Owner for all acts or omissions of its Subcontractor. All contractual agreements with additional persons or entities serving as a subcontractor shall incorporate the Contract Documents, expressly identify the Owner as a third-party beneficiary, give the Owner all rights against the Subcontractor that it would have against the Contractor and state that the Owner shall enjoy all third-party beneficiary rights not prohibited by law.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution. The Contractor shall notify the Owner, the Architect, and the Construction Manager of any proposed subcontractor substitution a minimum of 10 days prior to such proposed change.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume

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toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, that the Contractor, by these Contract Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation ~~shall be equitably adjusted for increases in cost resulting from the suspension~~ may be equitably adjusted as negotiated by the parties.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. ~~If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.~~

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to ~~insurance and waiver of subrogation; insurance.~~ The Construction Manager and Contractor shall be responsible for coordinating the Work with the work of other Contractors, including the Owner's own forces or Separate Contractors so as to complete the Work in accordance with the Project schedule.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces or Separate Contractors, the Owner shall provide for coordination of such forces and Separate Contractors with the Work of the Contractor, who shall cooperate with them.

~~§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.~~

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Separate Contractors, Construction Manager and other Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of

their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces, Separate Contractors or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Construction Manager and Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor or other Contractors that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Construction Manager and the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's or other Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractors or other Contractors that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a Separate Contractors or to other Contractors, because of the Contractor's delays, improperly timed activities or defective construction. ~~The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces, Separate Contractors, or other Contractors.~~

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction, or to property of the Owner, Construction Manager, Separate Contractors, or other Contractors as provided in Section 10.2.5. Should a claim be made that the Contractor wrongfully delayed or caused damage to the Work or property of another contractor (including the Owner's own forces, other Contractors, or Separate Contractors), the Contractor shall promptly settle the dispute with such other contractor. If such other contractor sues the Owner on account of any delay or damage alleged to have been caused by the Contractor, the Construction Manager will notify the Contractor who shall defend such proceedings at the Contractor's sole expense. If any judgment or award against the Owner arises therefrom, the Contractor shall pay or satisfy it and shall reimburse the Owner for all costs, including attorneys' fees and court costs, which the Owner may have incurred.

§ 6.2.5 The Owner, Separate Contractors, and other Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, other Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and ~~the Construction Manager, with notice to the Architect, will~~ allocate the cost among those responsible. The Owner's right to clean up shall in no event be deemed a duty, and should the Owner choose not to pursue this remedy, the Contractor necessitating such action shall remain fully responsible for the same.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, only by Change Order, Construction Change Directive-Directive, written contract amendment, or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor. A Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect, and Contractor, stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.3 The Contractor's agreement on any Change Order shall constitute its final settlement of all matters relating to the direct and indirect costs associated with such change and any and all related adjustments to the Contract Sum and the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one or more of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall ~~determine~~ determine, with the Owner's approval, the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to a reasonable amount of the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Construction Manager and Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or

Contract Time. Contractor agreements to a Construction Change Directive shall require a follow-up writing or signature as contemplated in Section 7.3.7.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for undisputed Work completed under the Construction Change Directive in Applications for Payment. ~~The~~ For those undisputed portions, the Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of ~~cost~~ cost, if agreed to by the Owner in writing, shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of ~~either party~~ the Contractor to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree in writing with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the ~~adjustments~~, adjustments in writing, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Owner and Construction Manager and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Owner and Construction Manager that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for obtaining all supplies, materials, tools and equipment necessary to perform the Work and for properly performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. All work shall be completed in sufficient time to allow for clean-up and preparation for Owner move-in prior to the date of Substantial Completion.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 ~~Provided the Contractor submits a written request for an extension not more than fourteen days after the occurrence that gives rise to the delay, if the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner, Architect, Construction Manager, or an employee of any of them, or of the Owner's own forces, Separate Contractors, or other Contractors; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, fire, government-declared emergencies, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; litigation, mediation, or arbitration, as applicable; or (5) by other causes that the Contractor asserts and the Architect, based on the recommendation of the Construction Manager, determines justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.~~ may be extended by Change Order. Failure of the Contractor to submit a timely request for an extension shall irrevocably waive the Contractor's right to such an extension of time. If the contract time is subject to extension pursuant to this subparagraph, such extension shall be the exclusive remedy of the Contractor and the Contractor shall not be entitled to recover damages from the Owner. Further, minor modifications in Contract time resulting from adjustments in the Project construction schedule shall not be deemed a sufficient cause for an extension of time under this Section.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

~~§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.~~

§ 8.4 Delay Damage Claims

§ 8.4.1 If the Contractor fails to complete its Work on time resulting in loss or damage to the Owner, the Owner shall be entitled to recover any damages caused by the Contractor's breach, including overhead, profit, extended general conditions, actual attorney fees, etc.

§ 8.4.2 In the event the Contractor is delayed or hindered in the commencement or progress of the Work, including but not limited to those delays caused by the Work or lack of Work of another contractor or subcontractor on the Project, and the Contractor claims monetary damages as a direct and proximate consequences thereof (including, but not limited to, extended general conditions, overhead, profit, overtime, interest, supervisions or other costs or profits whatsoever), then the Contractor shall not assert such claims against the Architect, Construction Manager or Owner and, as to the Architect, Construction Manager and Owner, the Contractor's claims of such delay damages are hereby waived. The Contractor's sole and exclusive remedy regarding claims for monetary delay damages shall be to pursue such claims directly against any contractor(s) and/or subcontractors on the job which may have caused the delay, and with regard to such claims asserted against the Contractor by any other contractor(s) and/or subcontractors, the Contractor hereby waives the defense of absence of contractual privity and hereby assumes liability to other contractor(s) and/or subcontractors arising out of the Contractor's actions or inactions resulting in such delay and claim.

§ 8.4.3 For any delay claims raised against the Owner, the Contractor's sole and exclusive remedy is an extension of time to perform the Work not to exceed the time frame of any proven delay. Under no circumstances is the Contractor entitled to monetary delay damages from the Owner.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial

inequity to the Owner or Contractor, the applicable unit prices shall be equitably ~~adjusted~~adjusted, unless the Contractor provided such unit prices as a part of a competitive bid.

§ 9.2 Schedule of Values

~~Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, Before the first Application for Payment, the Contractor shall submit a schedule of values to the Construction Manager, before the first Application for Payment,~~ allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Construction Manager and the Architect. This schedule, unless objected to by the Owner, Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. The Construction Manager shall forward to the Owner and Architect the Contractor's schedule of values. Any changes to the schedule of values shall be submitted to the Construction Manager and supported by such data to substantiate its accuracy as the Construction Manager and the Architect may require, and unless objected to by the Construction Manager or the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of ~~values, if required under Section 9.2,~~ values for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner, Construction Manager or Architect require, such as copies of requisitions, and releases of waivers of lien from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Construction Manager and Architect, but not yet included in Change Orders. A Contractor's request for payment of sums related to work regarding Construction Change Directive shall, unless qualified in writing at the time of request, constitute full and complete consent to the Construction Change Directive(s) and to the issuance of a Change Order.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The Contractor shall submit with each monthly Application for Payment (1) an Affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the previous application was submitted and the Owner might in any way be responsible have been paid or otherwise satisfied, and (2) a release or waiver of liens rising out of the Contract from each Contractor and/or Subcontractor, materialman, supplier and laborer or the Contractor addressing all previous Applications for Payment submitted for the Project.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. Payment to Contractor for materials stored off site is discouraged. When circumstances indicate that the Owner's best interest is served by off-site storage, the Contractor shall make written request to the Owner and Construction Manager for approval to include such material costs in its next progress payment. The Contractor's request shall include the following information:

- .1 A list of the fabricated materials consigned to the Project (which shall be clearly identified, giving the place of storage, together with copies of invoices and reasons why materials cannot be delivered to the site.
- .2 Certification that items have been tagged for delivery to the Project and that they will not be used for another purpose.
- .3 A letter from the Contractor's Surety indicating agreement to the arrangements and that payment to the Contractor shall not relieve either party of their responsibility to complete the Work.

- .4 Evidence of adequate insurance covering the material in storage, which shall name the Owner as additionally insured.
- .5 Costs incurred by the Owner, Construction Manager and Architect to inspect material in off-site storage shall be paid by the Contractor.
- .6 Subsequent pay requests shall itemize the materials and their cost which were approved on previous pay requests and remain in off-site storage.
- .7 When a partial payment is allowed on account of material delivered on the site of the Work or in the vicinity thereof or under possession and control of the Contractor, but not yet incorporated therein, such material shall become the property of the Owner, but if such material is stolen, destroyed or damaged by casualty before being used, the Contractor will be required to replace it at its own expense.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Certificate for Payment, in the full amount of the Application for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there is more than one Contractor performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives all of the Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Contractor's application with information from similar applications for progress payments from the other Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.2.1 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either (1) issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager; or (2) issue to the Owner a Project Certificate for Payment for such amount as the Architect determines is properly due, and notify the Construction Manager and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Project Application for Payment, and notify the Construction Manager and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors. As between the Owner and the Contractor, the failure of the Architect or Construction Manager to notify the Contractor or the Owner of a withheld certification does not render such withholding ineffective, and the Owner shall have no obligation to pay a Contractor for uncertified amounts or amounts for which no Certificate for Payment has been issued. If the Contractor does not receive notice of a withheld certification, it shall proceed as provided in Section 9.7.

§ 9.4.3 The Construction Manager's certification of an Application for Payment or, in the case of more than one Contractor, a Project Application and Certificate for Payment, shall be based upon the Construction Manager's evaluation of the Work and the data in the Application or Applications for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information,

and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.4 The Architect's issuance of a Certificate for Payment or, in the case of more than one Contractor, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and data in the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is, or Contractors are, entitled to payment in the amount certified.

§ 9.4.5 The representations made pursuant to Sections 9.4.3 and 9.4.4 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Construction Manager or ~~Architect~~ Architect, in writing, together with the Certification which the qualification pertains.

§ 9.4.6 The issuance of a Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect ~~has~~ has, unless otherwise required by contract or law, (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.3 and 9.4.4 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

- ~~.1 defective Work not remedied;~~ remedied, or the Contractor is in breach of the Agreement;
- ~~.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;~~
- ~~.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;~~
- ~~.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;~~
- ~~.5 damage to the Owner or a Separate Contractor or other Contractor;~~
- ~~.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or~~
- ~~.7 repeated failure to carry out the Work in accordance with the Contract Documents.~~
- .8 the Work not having progressed to the extent set forth in the Application for payment; or
- .9 representations of the Contractor are untrue.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager, and both will reflect such payment on the next Certificate for Payment.

§ 9.5.5 If the Contractor disputes any determination by the Owner, Architect, or Construction Manager with regard to any Certificate for Payment, the Contractor shall nevertheless continue to expeditiously perform the Work and such dispute shall provide no basis for any manner of suspension of the Contractor's performance of the Work.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.1.1 The Owner may, in its sole discretion, choose to make payments to Contractors through the Construction Manager. More particularly, the Owner may distribute funds to the Construction Manager for the Construction Manager to then provide payment to each respective and applicable Contractor. The Owner may discontinue this practice at any time in its sole discretion.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4. Owner may, in its sole discretion, after providing Contractor with ten (10) days prior written notice, make direct payments to the Contractor's Subcontractors, material men, laborers or claimants relating to labor or material provided to the Contractor in the event the Subcontractors, material men, laborers or claimants threaten to or actually cease providing labor and/or materials for the Project due to nonpayment such that, in the Owner's determination, progress of the Project and the Project's schedule are jeopardized. All payments made pursuant to this section shall be considered the same as if paid directly to the Contractor and shall constitute partial payment of the Contract Sum. In the event the Contractor disagrees with the amount proposed to be paid to one or more Subcontractors, material men, laborers or claimants, the Contractor shall provide a bond in the amount the Contractor believes the Owner will overpay, within ten (10) days of receipt of notice, or be barred from making any claim that the amount of the direct payment was incorrect. Payment under this provision shall not jeopardize any other remedy available to the Owner.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary

liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 Subject to applicable law, if a petition in bankruptcy or any other arrangement or proceeding regarding insolvency, assignment for the benefit of creditors, trust, chattel mortgage, or similar state or federal proceeding, whether voluntary or involuntary, shall be filed with respect to the Contractor, the Owner may withhold the final balance, or any other payments, whether or not an application for progress payment has been properly filed, until expiration of the period of any guarantees or warranties required for the Contractor, and the Owner may pay out such funds the amount necessary to satisfy any claims or costs that otherwise would have been covered by such guarantees or warranties.

§ 9.7 Failure of Payment

If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, ~~Contractor and without justifiable basis under the Contract Documents, within~~ fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Construction Manager and Architect or awarded by binding dispute resolution, ~~then the Contractor may, upon seven~~ unless the Owner, in good faith, disputes the amount certified, ~~then the Contractor may, upon~~ twenty-one additional days' notice to the Owner, Construction Manager and Architect, stop the Work until ~~payment of the amount owing has been received. (1) the Contractor receives payment of the amount owing, or (2) the Contractor receives notice from the Architect, Construction Manager, or Owner of a full or partial withheld certification as provided herein.~~ The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents. The Owner shall have no obligation to pay the Contractor unless it receives a Certificate for Payment for the amount certified. The Owner may withhold payment from a non-performing Contractor irrespective of the issuance of a Certificate for Payment.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents and when all required occupancy permits, if any, have been issued, so the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager, and the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item ~~upon notification by the Architect, immediately.~~ In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work of all of the Contractors, or designated portion thereof, is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute, a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat,

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utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.8.6 Notwithstanding Sections 9.8.1 and 9.8.2, as a condition precedent to establishing the date of Substantial Completion, the Contractor shall prepare and submit to the Architect and Construction Manager a comprehensive list of items to be completed or corrected (a "punch list"). The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Should the Contractor fail to make corrections in a timely fashion, but not later than thirty (30) calendar days from the date of Substantial Completion or notification of the required corrections, whichever is earlier, such Work may be corrected by the Owner at the Contractor's sole expense, and the Contract Sum may be adjusted accordingly.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, ~~provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager complete.~~ The Contractor shall proceed with the work in such a manner as reasonably directed and shall cooperate with the Owner to limit interruptions.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a notice that the Work is ready for final inspection and acceptance, and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager shall perform an inspection to confirm the completion of Work of the Contractor. The Construction Manager shall make recommendations to the Architect when the Work of all of the Contractors is ready for final inspection, and shall then forward the Contractors' notices and Application for Payment or Project Application for Payment, to the Architect, who will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final ~~payment~~ payment, (5) an affidavit that states the Work is fully completed and performed in accordance with the Contract Documents and is satisfactory to the Architect and the Owner, (6) in the event of Contractor bankruptcy, at the Owner's option, an order entered by the court having jurisdiction of the Contractor's insolvency proceeding authorizing such payment, (7) a general release executed by the Contractor on a form provided by the Construction Manager, (8) all close-out documents and warranties have been provided in a reasonable and acceptable manner, (9) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6)-(10), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and ~~reasonable-actual~~ attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall ~~constitute a waiver of Claims by the Owner except those arising from~~
~~.1 — liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;~~
~~.2 — failure of the Work to comply with the requirements of the Contract Documents;~~
~~.3 — terms of special warranties required by the Contract Documents; or~~
~~.4 — audits performed by the Owner, if permitted by the Contract Documents, after final payment.~~ not constitute a waiver of any Claims by the Owner.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of all claims by that payee except those previously made in writing and identified by that payee as being unsettled and being an exception to the waiver of this section at the time of final Application for Payment.

§ 9.10.6 All architectural costs incurred after the specified Final Completion date resulting from the Contractor's failure to complete the Work as agreed shall be paid by the Contractor to the Owner prior to the authorization of final payment. Charges to the Contractor shall be made at such times and in such amounts as the Architect invoices the Owner under the current rate schedule in effect at the time of service, for services provided in connection with the Work. The architectural costs incurred after the final completion date will be deducted from the Contractor's progress payment or final payment as applicable.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or

Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor;
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction; and
- .4 construction or operations by the Owner, Separate Contractors, or other Contractors.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss. The Contractor shall take all reasonable safety precautions with respect to its Work and the work of others, shall comply with all standard industry safety measures and shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority and all other requirements of the Contract Documents, including those applicable to the safety of persons or property. The Contractor shall be responsible for the safety of all of the Contractor's employees and the safety of all of the Contractor's Subcontractors, suppliers, and their employees. The Contractor shall report in writing to the Construction Manager any injury to any of Contractor's or its Subcontractors' employees at the site within one (1) day after the occurrence of such injury. The Contractor acknowledges receiving, or having access to an opportunity to review, health and safety information about the Project site(s), including any applicable asbestos management plan and any other environmental information it deems necessary to perform the work.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, ~~reasonable~~-reasonable, necessary, and appropriate safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. The Contractor shall be solely and fully responsible for any and all damage claims and for defense of all actions against the Owner relating to such explosives, hazardous materials and/or unusual methods.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (~~other than damage or loss insured under property insurance required by the Contract Documents~~) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party the Contractor suffers injury or damage to person or property because of an act or omission of the other party, the Owner, or of others for whose acts such party the Owner is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party Owner within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter. Owner to investigate the matter. The Contractor's failure to do so shall be an irrevocable waiver of any claim against the Owner arising out of such injury or damage. Injury or damage to persons or property suffered by the Owner because of an act or omission of the Contractor or others for whose acts the Contractor is legally responsible shall be subject to the limitations provisions established by Michigan law.

§ 10.2.8.1 The Contractor causing damage to the Work of another Contractor shall be responsible for the repair and replacement of such damaged Work. Back charges may be made against the Contract sum of the damaging Contractor when corrections are not made promptly.

§ 10.2.8.2 The Owner reserves the right to pay the Contractor suffering damage from monies due the Contractor who is responsible for the Work required by same and shall deduct it from the Contract amount due the said responsible Contractor.

§ 10.2.9 If the Contractor or any Subcontractor chooses to use any systems, equipment, facilities, or services which have been incorporated in the Project as a permanent part thereof by any other, the Contractor shall assume full responsibility for damages caused to said systems, equipment, facilities or services, and have damages repaired as required, so that in no case will the performance of the used systems, equipment, facilities or services be diminished from the specified criteria as a result of such use.

§ 10.2.10 The Contractor acknowledges that the safety of the Owner's students, employees and guests is of the utmost importance. The Contractor will take no action which would jeopardize the safety of the Owner's students, employees and guests and, without the Owner's written approval, shall take no action which would interfere with the Owner's activities. Without limiting the foregoing provisions, the Contractor shall comply with all laws applicable to students and/or school safety.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner, Construction Manager and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner in its discretion shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall shall, as a courtesy, furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up to address shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and agents and employees of any of them from

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and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

~~§ 10.3.4~~ The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. ~~The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances site.~~ To the extent the Contract requires the removal, transport and disposal of hazardous materials, the Contractor agrees that it assumes responsibility for said tasks as a part of the Agreement.

~~§ 10.3.5~~ The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

~~§ 10.3.6~~ If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's reasonable discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7. Nothing in this section will be construed as relieving Contractor from the cost and responsibilities for emergencies covered hereby.

§ 10.5 Notification of Utility Companies

§ 10.5.1 At least five (5) working days prior to the start of work in areas which may involve existing utility lines, the Contractor shall notify the MISS DIG notification system of the planned work.

§ 10.5.2 The utility company should, upon receipt of notice, stake, mark or otherwise designate the location (and depth) of their lines, or temporarily move the line(s).

§ 10.5.3 The Contractor shall immediately report to the respective utility company any break or leak in its lines, or any dent, gouge, groove or other damage to the utility line or to its coating or cathodic protection made or discovered in the course of the Work.

§ 10.5.4 The Contractor shall immediately alert the Owner, Construction Manager, Architect and occupants of nearby premises of any and all emergencies caused or discovered in the utility lines(s) in the course of the Work.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the ~~Agreement or elsewhere in the Contract Documents.~~ Agreement, as described elsewhere in the Contract Documents, as required by law, or as reasonably required by the Owner in light of the nature of services performed and insurance obligations of its other contractors and consultants. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The ~~Owner, Construction Manager and Construction Manager's consultants, and the Architect and Architect's consultants,~~ Owner shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents. On all insurance contracts under which the Contractor is obligated to have its insurance company name the Owner as additional insured, the Contractor shall require such insurance company to add to the policy the following clause: "The insurance afforded to the Additional Insured is primary

insurance. If the Additional Insureds have other insurance which is applicable to the loss on an excess or contingent basis, the amount of the insurance company's liability under this policy shall not be reduced by the existence of such other insurance." Certificates of insurance acceptable to the Owner shall be submitted by Contractor to the Owner and Construction Manager prior to commencement of Work and thereafter upon renewal or replacement of each required policy of insurance.

§ 11.1.2 The Contractor shall provide bonds covering faithful performance of 100% of the Contract and payment of 100% of the obligations arising thereunder as stipulated in bidding requirements or specifically required by the Contract Documents or by law on the date of the Contract. The Contractor shall provide such additional surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is ~~located~~ located and that are reasonably acceptable to the Owner. The Construction Manager shall obtain copies of the Performance Bond and Payment Bond required by the Agreement from the Contractor prior to Contractor beginning performance pursuant to the Agreement. The Contractor's obligation to provide such bonds shall not be waived in any fashion, including any failure to secure such bonds prior to Contractor beginning performance pursuant to the Agreement.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice directly to the Owner, and separately to the Construction Manager, of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform both the Contractor and the Construction Manager, separately and in writing, prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. ~~In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~ Order.

§ 11.2.2.1 The Contractor shall at the Contractor's own expense provide insurance coverage for materials stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit until such materials are permanently attached to the Work.

§ 11.2.2.2 The insurance required by Section 11.2 is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work, but not incorporated into permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance for owned or rented machinery, tools or equipment.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice directly to the Contractor, and separately to the Construction Manager, of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; and (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. may be adjusted by negotiation between the parties. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Construction Manager and Construction Manager's consultants; (3) the Architect and Architect's consultants; (4) other Contractors and any of their subcontractors, sub-subcontractors, agents, and employees; and (5) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, other Contractors, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property. is not waiving any rights its insurer(s) may have to subrogation. To the extent any terms in the General Conditions or any other Contract Documents are contrary to the aforementioned, such terms shall be deemed void and unenforceable.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. ~~The Owner waives all rights of action against the Contractor, Architect, and Construction Manager for loss of use of the Owner's property, due to fire or other hazards however caused.~~

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, ~~as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Construction Manager, Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Construction Manager, Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.~~ insureds. The Owner shall use its best efforts, with consultation of the Construction Manager, to reach a quick and fair settlement for all interested parties, with the insurance companies after a loss.

~~§ 11.5.2~~ Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their examination and be replaced at the Contractor's expense without change in the ~~Contract Time~~ and Contract Sum.

§ 12.1.2 If a portion of the Work has been covered that the Construction Manager or Architect has not specifically requested to examine prior to its being covered, the Construction Manager or Architect may ~~request~~ request, with the Owner's consent, to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the ~~Contractor shall be entitled to an equitable adjustment to~~ Owner shall reasonably adjust the Contract Sum and Contract Time as may be appropriate. At the time, Owner's consent is sought as described herein, the Architect and/or Construction Manager shall notify the Owner that additional costs may apply if the Work is in accordance with the Contract Documents. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion, and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. If any portion of the Work is determined by the Owner, Construction Manager or Architect, either during performance of the Work or during any applicable warranty period, to be defective or not in compliance with the contract requirements, the Construction Manager or Owner shall notify the Contractor in writing that such Work is rejected. Thereupon, the Contractor shall immediately replace and/or correct such Work by making the same comply strictly with all the requirements therefor. The Contractor shall bear all costs of correcting such rejected Work, including work of other Subcontractors and including compensation for the Architect's and Construction Manager's additional services and any delay or related damage to the Owner made necessary thereby. The Construction Manager shall have the right to charge the Contractor for any compensation payable for the Architect's or Construction Manager's additional services required by the Contractor's rejected Work and deduct the payment from the next payment due the Contractor.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner or Construction Manager to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner or Construction Manager shall give such notice promptly after discovery of the condition. ~~During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty.~~ If the Contractor fails to correct

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nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, Construction Manager or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner, Separate Contractors, or other Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.2.6 The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Failure to correct Work deficiencies and/or punch list items in a timely fashion shall be a substantial breach, and the Owner may terminate the Contract immediately without following the procedure identified in Section 14.2. As used in this Section 12.2.6, "timely" means the Contractor shall begin correction within three days of receiving the punch list or notice of work deficiency, and correction will be completed in a commercially reasonable time in accordance with the direction of the Construction Manager. Whether or not the Contract is terminated, if the Contractor fails to make corrections in a timely fashion, such Work may be corrected by the Owner, in its sole discretion, at the Contractor's expense and the Contract Sum may be adjusted by backcharge accordingly. The Contractor shall promptly notify the Construction Manager, in writing, when the Work deficiencies and/or punch list items are completed. Upon the review of the Work by the Construction Manager after such notification by the Contractor, if Work deficiencies and/or punch list items shall continue to exist, the Contractor shall reimburse any cost incurred by the Owner, including the Construction Manager's and Architect's fees for reinspections of the Work. Failure to pay such costs within ten (10) days of receipt of a demand regarding the same shall permit the Owner to withhold such amounts from the unpaid portion of the Contractor's contract.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made. The acceptance of nonconforming Work by the Owner shall be by written Change Order, specifically referencing that it addresses nonconforming work, acceptable to the Owner's authorized representative, and signed by all parties. Acceptance of nonconforming Work may only occur pursuant to such written Change Order.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the ~~place where the Project is located excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.~~ State of Michigan in all respects, except that claims and causes of action brought by the Owner shall not be deemed untimely if filed within six (6) years of substantial completion of the entire (and all) Project(s).

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Construction Manager, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Construction Manager, Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, Documents or applicable law, all costs made necessary by such failure, including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

§ 13.4.5 If the Construction Manager or Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.6 The Contractor agrees that time is of the essence and to start work when directed by the Construction Manager and to furnish sufficient materials and a sufficient number of properly skilled workers, so as not to delay the work of any other Contractor or completion of the Project.

§ 13.7 Notwithstanding any provisions within the Contract Documents, nothing shall be deemed a waiver of any immunity granted to Owner by law or statute, including but not necessarily limited to, governmental immunity under MCL 691.1407.

§ 13.8 The Owner, being a governmental unit, is protected by the Michigan Void Construction Contracts Act, MCL 691.991.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days for reasons within the Owner's control through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, ~~for which may include any~~ of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 ~~An act of government, such as a declaration of national emergency, that requires all Work to be stopped;~~
- .3 ~~Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents, subject to justifiable withholding of payment as described herein or in the Contract Documents; or~~
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and ~~profit~~ direct costs on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive ~~days~~ days, for reasons within the Owner's control and through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees, or any other persons performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3. The Contractor may not terminate the Contract unless it has submitted claims for the delays and sought an extension of time for each delay.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 ~~repeatedly~~ refuses or fails to supply enough properly skilled workers or proper materials; materials to the point of negatively impacting the Project and/or the related schedule;

- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents; or
- .5 fails to prosecute the Work or any part thereof with promptness and diligence or fails to perform any provisions of this Contract, or goes into bankruptcy, liquidation, makes an assignment for the benefit of creditors, enters into a composition with its creditors, or becomes insolvent.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, after consultation with the Construction Manager, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, ~~seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety;~~ three days' notice, terminate the Contractor's right to proceed with the Work, or such part of the Work as to which such defaults have occurred, and may take any one or more of the following actions:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

The notice required by this Section 14.2.2 shall not give the Contractor a right to cure defective Work or to cure other grounds for termination under Section 14.2.1. Further, the Owner's failure to strictly comply with the formal requirements of termination (e.g., by providing less than three days' notice of termination) shall not be a substantial breach by the Owner. The Owner may terminate the Contractor immediately if a Contractor endangers persons or property or has breached Project safety requirements).

In the event, the Contractor's surety bond requires notice of intent to declare a default of the Contractor and if such bond notice is provided by the Owner, such notice shall be adequate to satisfy the three (3) day written notice described above in this section.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner in pursuing termination and completion of the Work, including actual attorney and legal fees and costs, and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

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§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement. ~~termination.~~

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 **Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the ~~Contract.~~ Contract, including but not limited to additional sums, additional time for performance, or damages for delay. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents. The Contractor shall not knowingly (as "knowingly" is defined in the Federal False Claims Act, 31 USC 3729, et seq.) present or cause to be presented a false or fraudulent Claim. As a condition precedent to making a Claim by the Contractor, the Claim shall be accompanied by an affidavit sworn to before a notary public or other person authorized to administer oaths in the State of Michigan and executed by an authorized representative of the Contractor, which states that: "The Claim which is submitted herewith complies with subparagraph 15.1.1 of the General Conditions, as amended, which provides that the Contractor shall not knowingly present or cause to be presented a false or fraudulent claim." Claims of the Owner shall be governed by the relevant Michigan statutory limitations period.

§ 15.1.2.1 Regardless of any provisions to the contrary, the statute of limitations with respect to any defective or nonconforming Work which is not discovered by the Owner shall not commence until the discovery of such defective or nonconforming Work by the Owner. See also Section 13.1.

§ 15.1.2 Time Limits on Claims

~~The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2, in accordance with Section 13.1 and Section 15.1.2.1, regardless of any other time frames identified in this Agreement. The Contractor shall commence all claims and causes of action in accordance with Section 15.1 and, if shorter, any other provisions of this Agreement and Michigan law.~~

§ 15.1.2.1 Regardless of any provisions to the contrary, the statute of limitations with respect to any defective or nonconforming Work which is not discovered by the Owner shall not commence until the discovery of such defective or nonconforming Work by the Owner. See also Section 13.1.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 ~~Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by written notice to the other party Owner and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party the Contractor under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant Contractor first recognizes the condition giving rise to the Claim, whichever is later. Failure to timely and properly initiate a claim shall be an irrevocable waiver of such claim. Claims by the Owner shall be governed by the applicable statute of limitations period, except as such time frame may be longer in accordance with Section 13.1 and Section 15.1.2.1.~~

~~§ 15.1.3.2~~ Claims by ~~either the Owner or Contractor~~, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by written notice to the other party. In such event, no decision by the Initial Decision Maker is required. Claims by the Contractor under this Section 15.1.3.2 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the Contractor first recognizes the condition giving rise to the Claim, whichever is later. Failure to timely and properly initiate a claim shall be an irrevocable waiver of such claim. Claims by the Owner shall be governed by the applicable statute of limitations period, except as such time frame may be longer in accordance with Section 13.1 and Section 15.1.2.1.

§ 15.1.4 Continuing Contract Performance

~~§ 15.1.4.1~~ Pending final resolution of a Claim, including by mediation and/or litigation, as applicable, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make undisputed payments in accordance with the Contract Documents.

~~§ 15.1.4.2~~ The Contract Sum and Contract Time ~~shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15,~~ may be adjusted as mutually agreed by the Owner and Contractor. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

~~§ 15.1.5~~ **Claims for Additional Cost.** If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Failure to provide such notice shall serve as an absolute bar against a claim for such an increase in the Contract Sum. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. A Project delay shall not be a basis for a Claim for additional cost. Delay claims against the Owner may be remedied only through an extension of time per Section 8.4.2 and Section 8.4.3.

§ 15.1.6 Claims for Additional Time

~~§ 15.1.6.1~~ If the Contractor wishes to make a Claim for an increase in the Contract Time, additional notice as provided in Section 15.1.3 shall be ~~given~~ given in addition to the general requirements for filing a claim. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of ~~the Work~~ the Work due to the increase in Contract Time sought. In the case of a continuing delay only one Claim is necessary.

~~§ 15.1.6.2~~ If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

~~§ 15.1.7~~ **Waiver of Claims for Consequential Damages.** The Contractor ~~and Owner waive Claims against each other~~ waives Claims against the Owner for consequential damages arising out of or relating to this Contract. This ~~mutual~~ waiver includes

- ~~1~~ damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- ~~2~~ damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This ~~mutual~~ waiver is applicable, without limitation, to all consequential damages due to ~~either party's termination~~ the Owner's termination of the Contractor in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated ~~damages~~ damages in favor of the Owner, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

~~§ 15.2.1~~ Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial ~~decision~~ interpretation. The Architect will serve as the Initial Decision ~~Maker, unless otherwise indicated in the Agreement.~~ Maker. Except for those Claims excluded by this Section 15.2.1,

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an initial ~~decision-interpretation~~ shall be required as a condition precedent to mediation of any Claim. ~~If an initial decision or litigation of any Claim brought by the Contractor against the Owner. If an initial interpretation has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision-an interpretation having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide-interpret disputes between the Contractor and persons or entities other than the Owner.~~

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to ~~resolve the Claim, interpret the Claim.~~ Within ten (10) days of a written request, the Contractor shall make available to the Owner or its representative all of its books, records, or other documents in its possession or to which it has access relating to a Claim and shall require its subcontractors, regardless of tier, and materialmen to do the same.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker ~~will will, based on its interpretation,~~ either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial ~~decision-interpretation~~ approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial ~~decision-interpretation~~ shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties, the Construction Manager, and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. ~~The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution-interpretation shall be subject to the parties' agreed upon binding dispute resolution process.~~

§ 15.2.6 ~~Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1. Regardless of any other time frames identified herein, claims and causes of action brought by the Owner shall be governed in accordance with the statute of limitations periods under Michigan law, except for such longer periods of time as may be permitted in Section 13.1 and Section 15.1.2.1.~~

§ 15.2.6.1 ~~Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days of receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.~~

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy. **SURETY NOTICE AND PRIOR APPROVAL**

Except where otherwise expressly required by the terms of the Agreement, the Contract Documents or the General Conditions, exercise by the Owner of any contractual or legal right or remedy without prior notice to or approval by the Contractor's surety shall in no way bar or prohibit the Owner's ability to pursue such right or remedy. Further, pursuit of such a right or remedy without prior notice to or approval of surety shall in no way compromise, limit or bar any claim by the Owner against a surety bond of the Contractor. The Owner's claims against a Contractor's surety bond shall be governed by Section 13.1 with respect to any limitations periods.

~~§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.~~

~~§ 15.3 Mediation~~

~~§ 15.3.1 Claims, Except as otherwise agreed in writing by the parties, claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.~~

~~§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of commencement of the parties' agreed upon binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.~~

~~§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.~~

~~§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.~~

~~§ 15.4 Arbitration~~

~~§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.~~

~~§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.~~

~~§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

~~§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

~~§ 15.4.4 Consolidation or Joinder~~

~~§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration. The Owner, at its sole discretion, may consolidate mediation conducted under this~~

Init.

Agreement with any other ~~arbitration-mediation~~ to which it is a party provided that (1) the ~~arbitration-mediation~~ agreement governing the other ~~arbitration-mediation~~ permits consolidation, (2) the ~~arbitrations-mediations~~ to be consolidated substantially involve common questions of law or fact, and (3) the ~~arbitrations-mediations~~ employ materially similar procedural rules and methods for selecting ~~arbitrator(s)-mediator(s)~~.

§ 15.4.4.2 ~~Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party-~~The Owner, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in ~~arbitration, mediation,~~ provided that the party sought to be joined consents in writing to such joinder. Consent to ~~arbitration-mediation~~ involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 ~~The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.~~Contractor further agrees to include similar dispute resolution provisions in all agreements with the independent contractors and consultants retained for the Project and to require all independent contractors and consultants also to include similar dispute resolution provisions in all agreements with subcontractors, all subconsultants, suppliers or fabricators so retained, thereby providing for a consistent method of dispute resolution between the parties to those agreements. Subject to the other limitations periods identified in these General Conditions which are understood to govern over this sentence, no demand for mediation shall be made after the date when the applicable statutes of limitations would bar legal or equitable proceedings. During the pendency of any mediation, all applicable limitations periods shall be tolled until the conclusion of that process.

The Owner reserves the right in its discretion to require consolidation or joinder of any mediation arising out of or relating to this Agreement with another mediation involving a person or entity not a party to this Agreement in any event the Owner believes such consolidation or joinder is necessary in order to resolve a dispute or avoid duplication of time, expense or effort. In the event the Owner is involved in a dispute which is not subject to mediation involving a person or entity not a party to this Agreement, the mediation provisions applicable to the parties shall be deemed to be void and nonexistent in the event Owner, in its discretion, determines the Contractor should become a party to that dispute by joinder or otherwise. Any mediation hearing shall be held in the general location where the Project is located unless another location is mutually agreed upon.

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Addenda are written or graphic instruments issued prior to execution of construction contracts which add to, delete from, clarify, or correct the Bidding Documents and/or the Contract Documents.
- B. Addenda may be included in the Bidding Documents and may be included in the Contract Documents.
- C. Addenda may be issued by either the Architect or the Construction Manager as deemed necessary to facilitate the building and construction of the Project.

1.01 BIDDERS' AND CONTRACTORS' RESPONSIBILITIES

- A. Each Bidder shall be responsible for taking the provisions of all Addenda issued prior to the Bid Date into account during the presentation of his Proposal.
- B. Each Bidder shall be responsible for obtaining all Addenda, and for ascertaining that all Addenda issued prior to the Bid Date have been considered in preparing his Proposal.
- C. Each Contractor shall perform his work in accordance with all Addendums issued.

END OF SECTION 00900

**MILESTONE
SCHEDULE
ON
FOLLOWING
PAGE(S)**

END OF SECTION 00999



Hemlock Public Schools
 Bid Pack #1
 Hemlock Stadium Turf
 K.C. Ling Elementary
 Milestone Schedule 2023



Fri 12/30/22

ID	Task Name	Duration	Start	Finish	January	February	March	April	May	June	July	August	September				
					1/2/25 1/1 1/8 1/15 1/22 1/29	2/5 2/12 2/19 2/26	3/5 3/12 3/19 3/26	4/2 4/9 4/16 4/23 4/30	5/7 5/14 5/21 5/28	6/4 6/11 6/18 6/25	7/2 7/9 7/16 7/23 7/30	8/6 8/13 8/20 8/27	9/3 9/10				
1	Bidding	47 days?	Thu 1/5/23	Fri 3/10/23													
2	Bid Period	13 days	Thu 1/5/23	Mon 1/23/23													
3	Pre-Bid Meeting	8 days	Wed 1/11/23	Fri 1/20/23													
4	Bid Due Date	0 days	Fri 1/20/23	Fri 1/20/23													
5	Post Bid Interviews	2 days	Mon 1/23/23	Tue 1/24/23													
6	Award Recommendation	1 day	Thu 1/26/23	Thu 1/26/23													
7	Owner Approval of Contracts	1 day	Wed 2/1/23	Wed 2/1/23													
8	Prepare and Issue Contracts	4 days	Thu 2/2/23	Tue 2/7/23													
9	Submittal Process	20 days	Mon 2/6/23	Fri 3/3/23													
10	Material Ordered	10 days	Mon 3/6/23	Fri 3/17/23													
11	SPRING BREAK (FIELD MEASURING Available by appt.)	5 days	Mon 3/27/23	Fri 3/31/23													
12	Pre-Construction Meeting (Tentative)	1 day	Wed 3/15/23	Wed 3/15/23													
13																	
14	Football Field	64 days?	Mon 4/3/23	Thu 6/29/23													
15	Site utility identification	2 days	Mon 4/3/23	Tue 4/4/23													
16	Mobilize	1 day	Mon 4/3/23	Mon 4/3/23													
17	Track Bridge/Temp Entrance	2 days	Tue 4/4/23	Wed 4/5/23													
18	Football Field Demo	7 days	Mon 4/3/23	Tue 4/11/23													
19	Install Catch Basins- drainage	10 days	Wed 4/12/23	Tue 4/25/23													
20	Sawcut Track	3 days	Wed 4/26/23	Fri 4/28/23													
21	Pour concrete curbs	8 days	Wed 4/26/23	Fri 5/5/23													
22	Electrical Work- pertaining to football field	6 days	Wed 5/3/23	Wed 5/10/23													
23	Plumbing work- pertaining to football field	6 days	Wed 5/10/23	Wed 5/17/23													
24	High Jump Area	10 days	Thu 5/18/23	Wed 5/31/23													
25	Goal Post Bases	4 days	Thu 6/1/23	Tue 6/6/23													

Task **Project Summary** **Inactive Milestone** **Manual Task**

Split **External Tasks** **Inactive Milestone** **Manual Task**

Milestone **External Milestone** **Inactive Milestone** **Manual Task**

Summary **Inactive Task**

Duration-only **Manual Summary Rollup** **Manual Summary** **Start-only**

Finish-only **External Tasks** **External Milestone** **Progress**

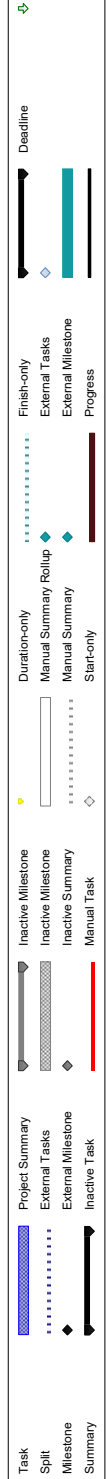
Deadline



Hemlock Public Schools
Bid Pack #1
Hemlock Stadium Turf
K.C. Ling Elementary
Milestone Schedule 2023



ID	Task Name	Duration	Start	Finish	January 1/2/25 1/1 1/8 1/15 1/22 1/29	February 2/5 2/12 2/19 2/26	March 3/5 3/12 3/19 3/26	April 4/2 4/9 4/16 4/23 4/30	May 5/7 5/14 5/21 5/28	June 6/4 6/11 6/18 6/25	July 7/2 7/9 7/16 7/23 7/30	August 8/6 8/13 8/20 8/27 9/3 9/9	Se
26	Stone Infill/ turf drainage system	10 days	Wed 6/7/23	Tue 6/20/23									
27	Install Turf Boxes	2 days	Wed 6/21/23	Thu 6/22/23									
28	Final Grading/prep for turf/goal post install	4 days	Thu 6/22/23	Tue 6/27/23									
29	Install Turf	17 days	Wed 6/28/23	Thu 7/20/23									
30	Site restoration and landscaping	2 days	Fri 7/21/23	Mon 7/24/23									
31	Final Inspections	1 day	Tue 7/25/23	Tue 7/25/23									
32	Turnover to Owner	1 day	Wed 7/26/23	Wed 7/26/23									
33	Punch list by Architect/Engineers	1 day	Wed 7/26/23	Wed 7/26/23									
34	Punch List Work by All Contractors	5 days	Mon 7/31/23	Fri 8/4/23									
35													
36	KC Ling Elementary	55 days?	Mon 6/5/23	Fri 8/18/23									
37	Site utility identification	2 days	Thu 6/1/23	Fri 6/2/23									
38	Mobilize	1 day	Mon 6/5/23	Mon 6/5/23									
39	Site Work	50 days	Tue 6/6/23	Mon 8/14/23									
40	Drives, parking lots, softball field, tennis courts	day?											
41	Interior Demo (General Trades/Electrical/Mechanical)	15 days	Tue 6/6/23	Mon 6/26/23									
42	Interior Work (weekly schedule TBD)	49 days	Tue 6/6/23	Fri 8/11/23									
43	Electrical/Mechanical Finishes	5 days	Mon 8/14/23	Fri 8/18/23									
44	Final painting	5 days	Mon 8/14/23	Fri 8/18/23									
45	Final Inspections	1 day	Fri 8/18/23	Fri 8/18/23									
46	Final Cleaning	1 day	Fri 8/18/23	Fri 8/18/23									
47	Punch list by Architect/Engineers	1 day	Mon 8/21/23	Mon 8/21/23									
48	Turnover to Owner	1 day	Mon 8/21/23	Mon 8/21/23									
49	Punch List Work by All Contractors	5 days	Tue 8/22/23	Mon 8/28/23									



Task **Project Summary** **External Tasks** **Inactive Milestone** **Inactive Task** **Manual Task**

Split **Manual Summary Rollup** **Manual Summary** **Start-only**

Milestone **External Milestone** **Inactive Milestone** **Manual Milestone**

Summary **Progress** **Deadline**

PART 1 – GENERAL

1.01 PROJECT DESCRIPTION

A. Hemlock Public Schools – Bid Package #1

1.02 CONTRACTORS USE OF PREMISES

- A. Contractors shall limit their use of the Project site for Work and for storage, to allow for:
1. Work by other Contractors.
- B. Contractors shall coordinate their use of the Project site under the direction of the Construction Manager.
- C. Contractors shall assume full responsibility for the protection and safekeeping of materials and equipment stored on the site. No security will be employed.
- D. Each Contractor shall move any stored material or equipment under their control if it interferes with operations of the Owner or other Contractors, as directed by the Construction Manager.
- E. Contractors shall obtain and pay for additional storage or work areas needed for operations not allowed on the site.

1.03 OWNER OCCUPANCY

- A. The owner intends to occupy the Project by **August 21, 2023**. All contractors must comply with this requirement.

1.04 OWNER FURNISHED PRODUCTS

- A. Products furnished and paid for by the Owner are described in the Specifications and in the Bid Division List (Section 00309).
- B. Owner's Responsibilities Regarding Owner-Furnished Products:
1. Arrange for and deliver necessary shop drawings, product data and samples to the installing contractor,
 2. Arrange and pay for product delivery to the site, in concert with the Short Term Construction Activities Plan,
 3. Arrange for the suppliers to submit bills of materials to Contractors,
 4. Inspect deliveries jointly with Contractors,
 5. Submit claims for transportation damage,
 6. Arrange for replacement of damaged, defective, or missing items,
 7. Arrange for manufacturer's warranties, bonds, service, and inspections, as required.

- C. Contractor's Responsibilities Regarding Owner-Furnished Products:
1. Designate needed delivery dates for each product in the Short Term Construction Activities Plan,
 2. Review shop drawings, product data and samples,
 3. Review and return Owner-Furnished shop drawings, data and samples with notification of any discrepancies or problems anticipated in use of the product, within 2 weeks,
 4. Promptly inspect products jointly with the Owner, and record shortages, damaged items and defective items,
 5. Handle products at the site, including uncrating and storage,
 6. Protect products from exposure to elements, and other forms of damage,
 7. Assemble, install, connect, adjust and finish products as stipulated in the Specification,
 8. Repair or replace items damaged by Contractor,
 9. Dispose of all crating, wrapping, and trash related to the material.

END OF SECTION 01010

PART 1 – GENERAL

1.01 NORMAL WORK HOURS

A. 7 a.m. to 5 p.m., Monday through Friday.

1.02 EXCEPTIONS

- A. Necessary variations of normal work hours shall only occur with the express approval of the Construction Manager on the Owner’s behalf.
- B. As a condition to the contract, the Contractor agrees that no premium-time, over-time or other special rae shall be charged for the scheduled completion of the project for any reason or cause.
- C. It will be the responsibility of each Contractor to provide an adequate work force to assure the timely completion of all Work.
- D. The Contractor will work whatever hours required (overtime, weekends, holidays) to complete their work and allow for the completion of all other work to achieve final completion in the time frames required by the Owner.

END OF SECTION 01030

PART 1 – GENERAL

1.01 CONSTRUCTION MANAGEMENT

- A. This is a Construction Management project. There is no General Contractor. All Contractors on this Project are Prime Contractors. The Owner will award contracts for all Bid Divisions involved in the Project. The Project will be controlled and administered by a Construction Manager.

1.02 WORK ASSIGNMENTS

- A. Nothing contained on the Contract Documents, and especially in the work scope of any Bid Division, shall be construed as a Work assignment to any construction trade industry. Each Contractor is responsible for their own decisions on Work assignments, and shall make them in accord with the prevailing practice in the areas of the Project, and in such a way that neither their progress nor the progress of others will be adversely affected.
- B. Disputes that may arise over improper assignments or over assignments claimed by more than one Contractor shall be settled immediately by the Contractors and shall in no case result in a slow down or stoppage of Work of any Contractor.

1.03 RETAINAGE ON OWNER PURCHASED ITEMS

- A. The Owner may retain an amount of Five Thousand (\$5,000.00) or ten percent (10%); whichever is the larger amount, on material and/or equipment purchased from suppliers for inclusion in the Work, until such time as it is satisfactorily installed. The purpose of this provision is to ensure proper conformance to the Contract Documents.

1.04 PERFORMANCE OF WORK

- A. All Contractors shall provide weekly input to aid in the preparation of the Look Ahead Schedule by which the Project will be built. Consequently, it is the responsibility and obligation of each Contractor to utilize their manpower and resources according to the commitments made under the Look Ahead Schedule.

1.05 PROMPTNESS OF EXECUTION

- A. It is the intention of the Owner to complete the Project in the fastest practical time frame. Whereas varying conditions inherent in the construction process will affect the progress of the Work, it is the intent of each construction contract that the Contractor maintain the progress pace set forth in the CAP schedule.

1.06 PROGRESS PAYMENTS

- A. It is the intention of the Owner to recognize timely performance prescribed in the CAP. Contractors who maintain specified progress will be eligible for 100% Progress Payments.
- B. Contractors who fail to maintain specified progress may be subject to retainage up to 100% of Progress Payments, at such times as those Contractors are judged by the Construction Manager, and/or the Project Architect, to be behind schedule.

1.07 PAYMENT FOR STORED MATERIALS

- A. As a means of eliminating cost escalation on available items of material and equipment, and in the interest of obtaining competitive Bids, the Owner will provide payment for contract items purchased early and stored on site, and in specific pre-approved instances, off the Project site as well. In order to qualify for such payment, the material or equipment must be safely stored, protected, and insured against loss or damage, inspected and dedicated to this Project only. Any extra cost of off-site storage is to be included as part of the Bid Proposal.

- B. Materials stored on the site shall be in the area designated by the Construction Manager. Materials or equipment lost through theft, or mishandling, shall be replaced by the Contractor, without cost to the Owner. The Contractor receiving materials shall provide and maintain protection of stored materials at no additional cost to the Owner. The contractor shall retain responsibility for any loss, damage or replacement costs of any and all stored materials.
- C. Requests for payment for materials delivered and stored at the site must have acceptable itemized bills attached and available at the time of delivery.

1.08 SCHEDULE OF VALUES

- A. The Schedule of Values (Section 00670) shall include the following mandatory items for any Contractor who provides on-site labor as a part of their Contract:

- 1. Labor for each portion of the work to be performed.
- 2. Materials for each portion of the work to be performed.
- 3. Performance Bond and Labor & Material Payment Bond (when required by Owner).
Value: Actual Cost of Bonds
- 4. Daily housekeeping and clean-up inclusive of any special cleaning and preparation required by the specifications for delivering the building for the Owners occupancy.
Value: Two percent (2%) of the total Contract Amount
- 5. Retainage / Punch List
Value: Ten percent (10%) of the total Contract Amount

- B. Monthly allocations shall be made to each item as appropriate and as directed by the Construction Manager.
- C. The value of the Housekeeping/Final Clean-Up item shall be two percent (2%) of the Contract value, or as described by the Construction Manager.

1.09 MATERIAL AND EQUIPMENT EXPEDITING

- A. The Construction Manager will initiate and coordinate an expediting program on the Owner's behalf in cooperation with each Contractor, incorporating all critical items of material and/or equipment provided under the various Bid Division contracts.
- B. Each Contractor shall provide the Construction Manager with a completed Material and Equipment Purchase/Delivery list and as a part of the Bid Division Descriptions. The Contractor's purchase order issue date, supplier name and phone number and the delivery date for each material and equipment item required for the project must be provided.
- C. Each Contractor shall further cooperate by keeping the Construction Manager informed of all changes in the commitments previously indicated in the Material and Equipment Purchase/Delivery list and when deemed necessary by the Construction Manager, provide source contacts for direct expediting by the Construction Manager.
- D. The Contractor must require all suppliers to notify the Contractor's office a minimum of twenty-four (24) hours prior to the delivery of any materials or equipment so the Contractor is present to receive and unload the delivery.
- E. If a Contractor is not present on the job site to receive and unload the Contractor's material or equipment the Construction Manager may have the owner authorize others to perform the work. All costs associated with such actions will be deducted from the payments due the Contractor.

1.10 PROTECTION OF THE WORK OF OTHERS

- A. Contractors shall consider protection of finished Work of prime importance. Care shall be taken by Contractors not to damage completed Work of other Contractors, and to provide adequate protection to their own completed Work. Contractors who damage the work of others or existing finishes shall be back charged all costs associated with repairing or replacing the damaged work.
- B. When moving laborers and/or materials across floors, grades, roofs, other vulnerable surfaces, or through occupied areas, the Contractor shall provide adequate surface protection to prevent damage to surfaces.

1.11 MANDATORY ATTENDANCE AT MEETINGS

- A. Each Contractor shall provide a representative of the Contractor authorized and empowered to enact decisions regarding schedule compliance, manpower commitments and cost changes at all Project and Progress Meetings.

1.12 PRE ON-SITE ACTIVITY MEETING

- A. Each Contractor is required to meet on the site with the Field Construction Manager prior to beginning their Work. The purpose of this meeting is to review the intent of the Contract Documents as they pertain to the Contractor's Work, and to integrate the Contractor's schedule into the Short Term Construction Activities Plan for the Project.

1.13 RETURN ACTIVITIES

- A. Each Contractor is required to report to the Field Construction Manager prior to resuming Work on the Project after an absence from the site of one or more working days. The purpose of reporting is to make the Field Construction Manager aware of the Contractor's re-involvement with the Project, and to provide an update regarding any conditions that could affect the continuing Work of the Contractor.

1.14 CUTTING AND PATCHING

- A. Each Contractor shall make arrangements with the Construction Manager for fitting their Work into the Project, and shall coordinate all fitting with other Contractors. Whenever any contractor has been given sufficient information as to required openings prior to beginning their Work, they shall pay the cost for cutting and/or restoring if they fail to provide proper required openings.
- B. Each Contractor shall be responsible for any cutting, fitting and patching that may be required to complete their Work if they have failed to properly notify the Construction Manager and preceding Contractors of any openings required. Contractors shall not endanger the Work of any other Contractor by cutting, excavating or otherwise altering any Work, and shall not cut or alter the Work of any other contractor except with the consent of the Construction Manager. Any costs caused by defective or ill-timed Work shall be borne by the party responsible for such Work.
- C. Cutting or restoring performed by any Contractor, for work that is rejected by the Architect shall be corrected under the direction of the Construction Manager, as instructed by the Architect. The Contractor responsible for the defective restoration shall incur the cost of such Work.
- D. Openings over six inches in diameter must be formed by the concrete contractor(s).
- E. Cutting and patching of concrete floors and decks shall be performed in a neat and workman like manner, using a coring machine. After coring, each Contractor shall pack and grout openings around sleeves or other Work penetrating floors and decks.

- F. No Contractor shall do any cutting that may impair the strength of any building or its components. No holes, except for small screws or bolts, may be drilled in beams or other structural members for the purpose of supporting or attaching Mechanical Work, without prior approval from the Architect.
- G. Each Contractor shall be responsible for the cutting and patching of holes and openings through existing walls, partitions, floors, ceilings, and roofs necessary for the installation of their work. If the location for a hole or opening is through an existing joist, beam, or column, the Contractor shall notify the Construction Manager who, after consultation with the Architect, will instruct the Contractor how to proceed.
- H. Each Contractor shall be responsible for the closing and patching of holes and openings through existing walls, partitions, floors, ceilings, and roofs created by demolition work they are shown to complete unless noted otherwise.
- I. Temporary removal and replacement of all ceilings not scheduled to be replaced shall be the responsibility of the Contractor requiring access.
- J. The Contractor responsible for patching shall provide both the rough (substrate) and finish surfaces. They shall employ only qualified tradesmen to assure that all work is done in a neat and workmanlike manner. All patching shall match adjacent surfaces.

1.15 BLOCKING, BACKING AND GROUNDS

- A. Each Contractor shall be responsible for providing the blocking, backing and grounds necessary for the installation of their work unless specifically noted on the drawings in which case said blocking, backing, and grounds shall be provided by the Bid Division supplying shown backing material.

1.16 ACCESS PANELS

- A. Each Contractor shall be responsible for furnishing the necessary access panels for items of work installed under their contract.
- B. Installation of all access panels shall be the responsibility of the contractor erecting the wall or ceiling system.
- C. If not specified, these access panels shall be approved by the Architect prior to installation.

END OF SECTION 01040

PART 1 – GENERAL

1.01 DESCRIPTION

- A. All Applications for Payment must be submitted on a “Contractor Invoice Form.”
- B. Contractor Invoice Form(s) will be sent to contractors each month by the Construction Manager. The Contractor Invoice Form must be returned to the Construction Manager by the due date (located in the upper left hand corner of the form) in order to be included in the current month Cost Control Manual to be submitted to the Owner. The due date can also be found on “Attachment A” of the Owner-Contractor contract.
- C. Any completed Contractors Invoice Form received by the Construction Manager **later** than the contract established due date **will not** be accepted and **will need to be re-billed the following month.**

1.02 SWORN STATEMENTS AND WAIVERS

- A. All Applications for Payment must be accompanied by a Sworn Statement and applicable waivers.
- B. For complete instructions on preparing Sworn Statements and Waivers, please reference Section 01050 – Sworn Statements and Lien Waivers.
- C. Final Sworn Statement and Full Unconditional Lien Waivers must be provided prior to the release of the final payment or exchanged for final payment by presenting them in person.

1.03 SCHEDULE OF VALUES

- A. All billings are processed on the basis of approved Schedules of Values. Absolutely NO CHANGES may be made to approved Schedule of Values.

1.04 CHANGE ORDERS

- A. Increases or decreases in the Contract Amount shall be through change orders.
- B. Each Change Order shall be listed as a new line item on Contractor Invoice Form. This is the only way a change order will be processed for payment.

1.05 APPROVAL OR REJECTION OF APPLICATION FOR PAYMENT

- A. Approved Applications for Payment will be included in the current month Cost Control Manual submitted to the Owner for their approval and payment. Following approval the Owner will process payments and forward them to the Construction Manager for accompaniment of appropriate waiver(s), and payment will be sent on to Contractor.
- B. Contractors with Applications for Payment that were adjusted or rejected will be contacted by Wolgast for explanation.
- C. No payment will be issued through the Owner for any progress payment when the substantiating sworn statement and lien waiver(s) from the previous payment have not been received by the Construction Manager.

END OF SECTION 01045

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Sworn Statement shall be included with each Application for Payment.
- B. A sample Sworn Statement follows as Pages 2 and 3 of this Section.
- C. Page 1 of the Sworn Statement shall contain all necessary Project information, including
 - 1. Date of Sworn Statement.
 - 2. County in which the deponent is at the time of the completion of the Sworn Statement.
 - 3. Deponent name.
 - 4. Contractor name on whose behalf the deponent is making statement.
 - 5. County in which the Project is situated.
 - 6. Project name and site location.
 - 7. Deponent signature and typewritten name.
 - 8. Notary name, signature, and commission expiration date.
- D. Page 2 of the Sworn Statement shall contain all necessary Project information, including:
 - 1. Project name and site location.
 - 2. Subcontractor/Supplier listings as submitted for approval at the beginning of the Project.
 - 3. Description of work to be completed by each subcontractor/supplier.
 - 4. Total contract amount for each subcontractor/supplier.
 - 5. Listings of amounts paid, amounts owing, retentions held, and balances to complete.

1.02 WAIVERS

- A. All Applications for Payment must be accompanied by a Sworn Statement and applicable waivers.
- B. Sample “partial” and “full” waivers follow as Pages 4 and 5 of this Section.

1.03 APPLICATION AND CERTIFICATE FOR PAYMENT

- A. No payment will be issued through the Owner for any progress payment when the substantiating sworn statement and lien waiver(s) from the previous payment have not been received by the Construction Manager.
- B. For additional information and instructions on the Application and Certificate for Payment, please reference Section 01045.

Sample Sworn Statement

STATE OF MICHIGAN
COUNTY OF _____

_____ Being duly sworn, deposes and says that
_____ Is the Contractor for an improvement to the following described real property situated in
_____ COUNTY, MICHIGAN, known as _____. That the following is a statement of each subcontractor and
supplier and laborer, for which laborer the payment of wages for fringe benefits and withholdings is due but unpaid, with whom the contractor has
subcontracted for performance under the contract with the owner or lessee thereof, and that the amounts due to the persons as of the date hereof
are correctly and fully set forth opposite their names, as follows on Page 2.

That the contractor has not procured materials from, or subcontracted with, any other person other than those set forth and owes no money for the
improvement other than the sums set forth.

Deponent further says that he or she makes the foregoing statement as the contractor for the purpose of representing to the owner or lessee of the
above described premises and his or her agents that the above described property is free from claims of construction liens, or the possibility of
construction liens, except as specifically set forth and except for claims of Construction Lien Act, Act No. 497 of the Public Acts of 1980, as amended,
being Section 570.1109 of the Michigan Compiled Laws.

Deponent Signature

Deponent Name – Typewritten

Subscribed and sworn before me this _____ day of _____, 19 _____.

Notary Public Signature

Notary Public Name – Typewritten

My commission expires: _____

Warning to the owner; an owner or lessee of the above described property may not rely on this sworn statement to avoid the claim of a
subcontractor, supplier, or laborer who has provided a notice of furnishing or a laborer who may provide a notice of furnishing pursuant to Section
109 of the Construction Lien Act to the designee or the owner of lessee if the designee is not named or has died.

Warning to the deponent; a person, who with intent to defraud, gives a false sworn statement is subject to criminal penalties as provided in Section
110 of the Construction Lien Act, Act No. 497 of the Public Acts of 1980, as amended, being Section 50.1110 of the Michigan Compiled Laws.

**PARTIAL UNCONDITIONAL WAIVER OF LIEN
Subcontractor/Supplier**

Check No. _____

Amount: \$ _____

Invoice#: _____

I/we have a contract with **Hemlock Public Schools – Bid Package #1** to provide

_____ For the improvement of the property described as **Hemlock Public Schools**, and hereby waive my/our construction lien to the amount of \$_____ for labor/materials provided through _____.

This waiver, together with all previous waivers, if any, (circle one) DOES / DOES NOT cover all amounts due to me/us for contract improvement through the date shown above.

(Name of Lien Claimant)

By: _____ Signed on: _____
(Signature of lien claimant or authorized officer or agent of lien claimant) (Date)

Address: _____

Telephone: _____

**FULL UNCONDITIONAL WAIVER OF LIEN
Subcontractor/Supplier**

Check No. _____

Amount: \$ _____

Invoice#: _____

My/our contract with **Hemlock Public Schools – Bid Package #1** to provide

_____ For the improvement of the property described as **Hemlock Public Schools**, having been fully paid and satisfied, all my/our construction lien rights against such property and hereby waived and released.

(Name of Lien Claimant)

By: _____ Signed on: _____
(Signature of lien claimant or authorized officer or agent of lien claimant) (Date)

Address: _____

Telephone: _____

END OF SECTION 01050

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Change Event Form will be used to document any request for a change in the scope of the Work throughout the construction process, and establish owner and architect approval prior to preparing a change order or having work performed.
- B. The Change Event Form will only be used when it IS NOT NECESSARY for work to be performed immediately.

1.02 PROCESSING OF CHANGE EVENT FORMS

- A. The Owner, Architect, Engineer, Construction Manager or Contractor may initiate a request for change during the Project in the form of a bulletin/proposal request, construction change directive, request for information, or value engineering proposal. Requests for changes shall be submitted to the Construction Manager for preparation and distribution of the Change Event Form.
- B. The Change Event will be accompanied by a copy of all related sketches, drawings, specifications, instructions, etc.
- C. The Construction Manager will forward the Change Event to the Contractor for the purposes of obtaining an itemized quote (including labor, material, equipment, units, rates, and subtotals) for the changes requested.
- D. The Contractor will complete and return the Change Event Form within five (5) days, or less, to the Construction Manager.
- E. The Construction Manager will review all Change Events and itemized detail for accuracy and validity within 48 hours of receiving said information.
- F. If the Construction Manager approves the costs or deductions submitted by the Contractor in the Change Event, the Construction Manager will:
 - 1. Forward one (1) copy of the Change Event with itemized detail to the Architect for review and endorsement, stipulating the date by the endorsed Change Event is to be returned.
 - 2. Discuss the Change Event and costs or deductions with the Architect to secure their endorsement.
 - 3. Forward one (1) copy of the Change Event with itemized detail to the Owner for approval and signature.
- G. After receiving the endorsed Change Event(s) timely from the Architect and Owner, the Construction Manager will prepare a Change Order for Contractor signature. The Contractor will sign the Change Order, acknowledging notice to proceed with change, and return a copy back to the Construction Manager.
- H. Only Change Events with the Architect's and Owner's signature of approval and acceptance will be processed into Change Orders.

1.03 PRICING GUIDELINES FOR CHANGE EVENTS

- A. Pricing Guidelines for Change Events that will be considered for Change Orders shall be fully detailed and itemized showing each of the following:
 - 1. Labor: All field labor indicating worker name, date, and hours worked and hourly rate; hourly rate shall be based on straight time only and shall include the labor classification.

2. Fringes: All established payroll taxes, assessments and fringe benefits on the labor in 7.3.2.1; this may include, but is not limited to, FICA, Federal and State unemployment, Health and Welfare and Workers Compensation; each of the fringes is to be a separate line item.
3. Material: All material purchased by the Contractor and incorporated into the changed Work, showing quantities, unit costs and costs of each item as appropriate; material costs will only be allowed at the Contractor's actual cost including any and all discounts, rebates or related credits. Only one third (33 percent) of the cost of reusable materials for each use, such as formwork lumber, shoring or temporary enclosures will be allowed.
4. Equipment: Rental Equipment – charges for certain non-owned, heavy or specialized equipment up to 100 percent of the documented rental costs; no rental charges will be allowed for hand tools, minor equipment, simple scaffolds, etc.; downtime due to Contractor caused delays, repairs, maintenance, late fees and weather will not be allowed. Owned Equipment – charges for certain owned, heavy or specialized equipment up to 100 percent of the cost listed by the Associated Equipment Dealers Blue Book; no charges will be allowed for hand tools, minor equipment, simple scaffolds, etc.; only the actual time the equipment is necessary to be in use to perform the work will be allowed; downtime due to Contractor caused delays, repairs, maintenance and weather will not be allowed.
5. A total amount of ten (10) percent of the total of all labor, materials and equipment performed by the Contractor's own forces shall be allowed for the Contractor's combined overhead and profit.
6. A total amount of ten (10) percent of the total of all extra work performed by the Contractor's Subcontractor(s) shall be allowed for the Contractor's combined overhead and profit.
7. For work deleted, that would have been completed by the Contractor or the Contractor's Subcontractor(s) an amount equaling the cost of the Work plus an amount equaling five (5) percent of the work shall be credited to the owner.

1.04 TIME LIMIT

- A. Contractor must return the Change Event and respective price quotations within five (5) working days, unless noted otherwise on the Construction Management issued Change Event.
- B. Failure to return the completed Change Event within the predefined time period will indicate the contractor shall have no charge for the associated work within their bid division per the Change Event at no additional cost to the Owner, Construction Manager and Architect.

END OF SECTION 01051

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Change Order Document is the legal instrument used to modify the Contract Documents.
- B. Change Orders will be prepared, as necessary, following the acceptance of the Change Event amount by the Owner (Section 01051).
- C. A sample Change Order follows as page 2 of this Section.

1.02 PROCESSING OF CHANGE ORDERS

- A. All changes and potential changes to the Project shall be documented by using the Change Event Form (Section 01051).
- B. Complete and approved Change Events will be converted into Change Orders as necessary.
- C. One (1) original Change Order shall be prepared by the Construction Manager and forwarded to Contractor for signature. Signatory parties shall include: the Contractor only on Change Order.

1.02 PRICING GUIDELINES

- A. Pricing Guidelines for Change Events that will be considered for Change Orders shall be fully detailed and itemized showing each of the following:
 - 1. Labor: All field labor indicating worker name, date, and hours worked and hourly rate; hourly rate shall be based on straight time only and shall include the labor classification.
 - 2. Fringes: All established payroll taxes, assessments and fringe benefits on the labor in 7.3.2.1; this may include, but is not limited to, FICA, Federal and State unemployment, Health and Welfare and Workers Compensation; each of the fringes is to be a separate line item.
 - 3. Material: All material purchased by the Contractor and incorporated into the changed Work, showing quantities, unit costs and costs of each item as appropriate; material costs will only be allowed at the Contractor's actual cost including any and all discounts, rebates or related credits. Only one third (33 percent) of the cost of reusable materials for each use, such as formwork lumber, shoring or temporary enclosures will be allowed.
 - 4. Equipment: Rental Equipment – charges for certain non-owned, heavy or specialized equipment up to 100 percent of the documented rental costs; no rental charges will be allowed for hand tools, minor equipment, simple scaffolds, etc.; downtime due to Contractor caused delays, repairs, maintenance, late fees and weather will not be allowed. Owned Equipment – charges for certain owned, heavy or specialized equipment up to 100 percent of the cost listed by the Associated Equipment Dealers Blue Book; no charges will be allowed for hand tools, minor equipment, simple scaffolds, etc.; only the actual time the equipment is necessary to be in use to perform the work will be allowed; downtime due to Contractor caused delays, repairs, maintenance and weather will not be allowed.
 - 5. A total amount of ten (10) percent of the total of all labor, materials and equipment performed by the Contractor's own forces shall be allowed for the Contractor's combined overhead and profit.

6. A total amount of ten (10) percent of the total of all extra work performed by the Contractor's Subcontractor(s) shall be allowed for the Contractor's combined overhead and profit.

7. For work deleted, that would have been completed by the Contractor or the Contractor's Subcontractor(s) an amount equaling the cost of the Work plus an amount equaling five (5) percent of the work shall be credited to the owner.

CHANGE ORDER

PROJECT:

PROJECT NO:

CHANGE ORDER NO.:

CHANGE ORDER DATE:

CONTRACT DATE:

CONTRACT NO.:

CONTRACTOR:

ARCHITECT:

OWNER:

It is hereby agreed to make the following changes to the Contract:

- 1. QR#
- 2. N/A
- 3. N/A
- 4. N/A
- 5. N/A

This work described by this Change Order becomes a part of and is to be performed by the same terms as the existing Contract. This Change Order must be signed by the Owner, Architect, and Contractor to be valid.

The Original Contract Sum.....	\$
Net change by previously authorized Change Orders.....	\$
The Contract Sum prior to this Change order.....	\$
The Contract Sum will be <input type="checkbox"/> increased / <input type="checkbox"/> decreased by this Change Order.....	
The new Contract Sum including this Change Order is.....	\$

<u>Contractor</u>	<u>Architect</u>	<u>Owner</u>
-------------------	------------------	--------------

By: _____	By: _____	By: _____
-----------	-----------	-----------

Date: _____	Date: _____	Date: _____
-------------	-------------	-------------

DISTRIBUTION - FULLY EXECUTED CHANGE ORDERS ARE COPIED AND DISTRIBUTED AS FOLLOWS:
White (original) – Owner; Blue – Construction Manager; Green – Contractor; Yellow – Architect

END OF SECTION 01053

PART 1 – GENERAL

1.01 LAYOUT AND MEASUREMENTS

- A. The responsibility for accurate layout and measurement of the Work of each Contractor is their own. In addition, each Contractor shall verify the dimensional accuracy of the Work upon which their own Work relies before they begin their Work. They shall report all inaccuracies to the Construction Manager, and shall not proceed until all corrections are made. If a Contractor proceeds with their Work on dimensionally inaccurate Work of another Contractor, they shall be liable for the cost of corrections to their own Work when the error is corrected, and shall cooperate in the correction as directed by the Construction Manager.
- B. The Owner, through the Construction Manager, will provide a bench mark and baseline for all Contractors' reference.
- C. If the Construction Manager performs layout work or must arrange for others to perform layout work that is the responsibility of the Contractor, those costs will be charged to the Contractor. The costs will be submitted to the Owner and the Owner will deduct those costs from the Contractor's contract payment.

END OF SECTION 01055

1.01 PREVAILING WAGE

- A. There is no prevailing wage on this project.

END OF SECTION 01060

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work included:

1. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and type of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship that meet or exceed the specifically names code or standard.
3. It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Owner, to deliver to the Owner all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Owner, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Owner.

B. Related Work Described Elsewhere:

1. Specific naming of codes or standards occurs on the Drawings and other Sections of these specifications.

1.02 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards.

1. In procuring all items used in this Work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.

B. Rejection of Non-Complying Items.

1. The Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements.
2. The Owner further reserves the right and without prejudice to other recourse the Owner may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Owner.

C. Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

1. AASHTO – American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, D.C. 20004.

ACI – American Concrete Institute, Box 19150, Redford Station, Detroit, Michigan 48219

AISC – American Institute of Steel Construction, Inc., 1221 Avenue of the Americans, New York, New York, 10020.

ANSI – American National Standards Institute (successor to USASI and ASAO), 1430 Broadway, New York, New York 10018.

ASTM – American Society for Testing Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

AWS – American Welding Society, Inc., 2501 N.W. 7th Street, Miami, Florida 33125.

AWWA – American Water Works Association, Inc., 6666 West Quincy Avenue, Denver, Colorado 80235.

BOCA – Building Officials Code Administrators International, Inc. 17926 South Halsted Street, Homewood, Illinois 60460.

CRSI – Concrete Reinforcing Steel Institute, 228 North LaSalle Street, Chicago, Illinois 60610.

CS – Commercial Standard of NBS, U.S. Department of Commerce, Government Printing Office, Washington, D.C. 20402.

FGMA – Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611.

State of Michigan Fire Marshall Bulletin 412.0.

NAAMM – The National Association of Architectural Metal Manufacturers, 1033 South Boulevard, Oak Park, Illinois 60302.

NEC – National Electric Code (see NFPA).

NEMA – National Electrical Manufacturer’s Association, 155 East 44th Street, New York, New York 10017.

NFPA – National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.

SDI – Steel Deck Institute, 135 Addison Avenue, Elmhurst, Illinois 60125.

SSPC – Steel Structures Painting Council, 4400 Fifty Avenue, Pittsburgh, Pennsylvania 15213.

TCA – Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

UL – Underwriters’ Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611.

Fed. Specs, and Fed. Standards: Specifications Sales (3FRI), Building 197, Washington Navy Yard, General Service Administration, Washington, D.C. 20407.

UBC – Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California 90601.

END OF SECTION 01085

PART 1 – GENERAL

1.01 ALTERNATES

- A. This section identifies each alternate by number and describes the basic changes to be incorporated into the work, only when that alternate is made a part of the Work by specific provisions in the Owner-Contractor Agreement.
- B. Related Requirements in other parts of the Project Manual:
 - 1. Method of quotation of the cost of each alternate, and the basis of the Owner’s acceptance of alternates: Bidding Documents
 - 2. Incorporation of alternates into the Work: Owner-Contractor Agreement.
- C. Related Requirements Specified in Other Sections:
 - 1. Part 1.01: Description of Work
 - 2. Sections of the Specifications as listed under the respective Alternates.
- D. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each Alternate.
- E. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate and to provide the complete construction required by the Contract Documents.
- F. The Owner reserves the right to accept the proposed amount for any alternate at any time during the active construction of the project. If the Owner elects to accept an alternate after the Owner-Contractor contract has been issued, the work shall be added to the contract by change order.

1.02 DESCRIPTION OF ALTERNATES

K.C. Ling Elementary:

- Alternate No 1 – Hemlock Elementary Café Canopy Add / Deduct \$ _____
- Alternate No 2 – Hemlock Elementary Multi-Purpose Room Acoustical Treatment Add / Deduct \$ _____
- Alternate No 3 – KC Ling Softball Field Add / Deduct \$ _____
- Alternate No 4 – KC Ling Sinks Add / Deduct \$ _____

Stadium Turf:

- Unit Price No 1 – Supplemental Excavation, Satisfactory Soil Fill Unit Price \$ _____
Cubic Yard \$ _____
- Unit Price No 2 – Supplemental Excavation, Engineered Fill Unit Price \$ _____
Cubic Yard \$ _____
- Unit Price No 3 – Unforeseen replacement of existing slab on grade Unit Price \$ _____
Cubic Yard \$ _____

END OF SECTION 01100

PART 1 – GENERAL

1.01 PRE-CONSTRUCTION MEETINGS

- A. Prior to the initiation of on-site activity, a meeting will be held with all Bid Division Contractors for the purpose of planning, scheduling, and coordinating an orderly initiation of on-site construction activity. Attendance at this meeting is required of all Contractors. The Construction Manager will advise all Contractors of the time and location of this meeting.
- B. A representative of the contractor authorized to enact decisions regarding schedule, manpower commitments and costs must attend the pre-construction meeting.

1.02 PRE-CONSTRUCTION CONFERENCES

- A. Each Contractor is required to meet on the site with the Construction Manager prior to beginning their Work. The purpose of this meeting is to review the intent of the Contract Documents as they pertain to the Contractor's Work, and to integrate the initiation of that Work with the Work already in progress on the site.

1.03 PROGRESS AND PROJECT MEETINGS

- A. Contractors active on-site shall be required to attend Progress and Project Meetings when called by the Construction Manager. These meetings are for the purpose of planning and assessing construction progress and for discussing problems of mutual concern.
- B. It is mandatory that any contractor actively engaged in work on site shall be required to have a representative of the contractor authorized and empowered to enact decisions regarding schedule, manpower commitments and costs and their superintendent be in attendance at these meetings, or the Owner may withhold the Contractor's payment.
- C. All decisions, instructions, and interpretations given by the Owner or their designated representatives at these meetings shall be conclusive, and shall be binding on the Contractors.
- D. The proceedings of such meetings will be recorded and posted. Copies will be forwarded to Contractors.

END OF SECTION 01200

PART 1 – GENERAL

1.01

- A. Contractor shall be solely responsible to submit all shop drawings, product data, and samples, or other items required by the Construction Documents hereinafter referred to as submittals to the Construction Manager for processing and forwarding to the Architect for their review.
- B. Submittals shall be delivered to the Construction Manager's office in accordance with the procedures and dates required by the Construction Documents and/or this section, Section 01300, of the project manual (specifications) whichever is more stringent in its requirement. All submittals shall be provided to the Construction Manager within 30 calendar days of receipt of the signed contract or Notice to Proceed unless specified otherwise in the Construction Documents.

1.02 SUBMITTALS - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- A. The Contractor shall submit to the Construction Manager individual submittals either via Procore or email. All files must include the specification number, item number and name as indicated in the submittal log.
- B. Contractor shall provide electronic copies of submittals. The submittals shall be in PDF format only. COLOR SAMPLES MUST BE SUBMITTED AS PHYSICAL SAMPLES.
- C. In submitting shop drawings, product data and samples, each Contractor represents that they have checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. All submittals must be stamped or signed by the contractor responsible for submitting, to attest to their review.

ALL SUBMITTALS MUST BE ACCOMPANIED BY THE WOLGAST CORPORATION SHOP DRAWING / SUBMITTAL FORM (see Page 2 of this section).

- D. Any submittal not accompanied by the Wolgast Corporation Shop Drawing / Submittal Form will be returned to the contractor for resubmittal.
- E. The Submittal Log provided as part of the Bid Division Descriptions shall be a guideline only and is not to be a representation of every or all submittals required for the completion of the Project. The Contractor shall be required to provide all items and perform all work in complete compliance with the Contract Documents.
- F. The Contractor shall not be relieved of the responsibility for any deviation in the work required by the Contract Documents, or any errors and omissions contained in shop drawings, product data; samples, or other submittal data reviewed and returned to the Contractor by the Architect. Any work performed prior to the Architect's review shall be subject to removal and replacement at the Contractor's expense.
- G. No portion of the Work requiring submission of shop drawings, product data or samples shall commence until the submission has been reviewed by the Architect. If any work is performed prior to the Architect's review of the required submittal(s), the work shall be subject to removal and replacement at the Contractor's expense if that work does not comply with the requirements of the contract documents.

1.03 START-UP DOCUMENTS (CONTRACT-AWARD SUBMITTALS)

- A. (Refer to Sections 00100, 00600, 00650, 00670, 00680, 00690.)

1.04 CONTRACT CLOSEOUT DOCUMENTS (CLOSE-OUT SUBMITTALS)

- A. (Refer to Sections 01700, 01720, 01730, and 01740.)

END OF SECTION 01300

PART 1 – GENERAL

1.01 CONSTRUCTION SCHEDULES

- A. A Milestone Schedule is provided as part of the bidding documents to indicate dates by which certain critical tasks and/or portions of the project must be completed. The Milestone schedule also indicates the date by which the Project must be 100% complete, receipt of final inspections, occupancy allowed by all governing authorities, and owner move-in.
- B. Based on the Milestone Schedule each Contractor shall submit to the Construction Manager, at or prior to the Pre-Construction Meeting, two (2) copies of the proposed progress schedule for their Work identifying the critical tasks that they must complete to achieve the Milestone Schedule completion dates.
- C. The Construction Manager will utilize the scheduling input from the Contractors for incorporation into the Project Construction Schedule. The Project Construction Schedule will be compiled and distributed to all contractors.
- D. By signing the Owner-Contractor Agreement the Contractor agrees to cooperate with all of the other multiple contractors and to coordinate all construction activities to allow the work of that contractor and all other contractors to meet the completion date(s) established in the Milestone Schedule. The Contractor also agrees that the Project Construction Schedule shall be followed to achieve or improve upon the completion dates for the various tasks in order to attain the final completion of the project by the scheduled completion date.
- E. The Construction Manager will, at times, issue a weekly Look-Ahead Schedule as part of the weekly Contractor Coordination Meetings. The Look-Ahead Schedule will support the Project Construction Schedule and provide specific scheduling information for the Contractor to assure the scheduled completion dates are achieved. The Contractor agrees to comply with the required work identified in the Look-Ahead Schedules.

END OF SECTION 01350

PART 1 – GENERAL

1.01 QUALITY CONTROL BY PROJECT ARCHITECT AND CONSTRUCTION MANAGER

- A. Each Contractor shall comply with the quality control provisions of the Contract Documents.
- B. The quality and completeness of the Work shall be maintained on a day-to-day basis. Inaccurate, faulty, incomplete, and defective Work shall be corrected by the Contractor without continuous prodding by the Construction Manager. Failure to cooperate in this continuous punch list effort may reduce Progress Payments.

1.02 CONTRACTOR QUALITY CONTROL

- A. Each Contractor shall be responsible to provide a quality workmanship consistent with the requirements of the Contract Documents. All Work will be of good quality and free from faults and defects. Every care shall be exercised to ensure that the quality specified is the quality provided.
- A. If at any time a Contractor is of the opinion that the quality of their Work is, or will be, jeopardized as a result of rescheduling or coordination of the Project, or for any other reason known to them, they shall stop work immediately and shall inform the Construction Manager of their action and the reasons thereof. The Contractor shall immediately provide a written explanation to the Field Construction Manager and Project Manager for the record, and shall mail a copy to the Architect. Upon investigation by the Construction Manager, a decision will be made on the note of jeopardy, in order to resolve the problem.
- C. Any Contractor who compounds a mistake by installing their product on another Contractor's obviously faulty work will assume responsibility for repair of said work.

END OF SECTION 01400

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Owner may employ and pay for the services of an independent testing laboratory to perform specified testing as identified in the Bid Division Descriptions.
- B. Contractors shall cooperate with the Laboratory to facilitate the execution of this service.
- C. Employment of the Laboratory shall in no way relieve the Contractor's obligation to maintain the quality of their work.

1.02 CONTRACTOR'S RESPONSIBILITIES

- A. Contractors shall cooperate with Laboratory personnel, and shall provide access to Work, and to manufacturers' operations.
- B. Contractors shall provide to the Laboratory samples of proposed materials, which require testing.
- C. Contractors shall provide to the Laboratory the preliminary design mix proposed to be used for concrete and other materials, which require control, by the Laboratory.
- D. Contractors shall furnish all test results and coordinate testing with the Construction Manager.
- E. Contractors shall furnish incidental labor and facilities necessary:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the Project site or at the source of the project to be tested.
 - 3. To facilitate inspections and tests.
- F. Contractors shall notify the Laboratory sufficiently in advance of operations to allow for Laboratory assignment of personnel and scheduling of tests.
- G. Contractors shall make arrangements with the Laboratory and pay for additional samples and tests required for Contractor's convenience.
- H. Contractors shall comply with the Project Team's instructions regarding testing.

END OF SECTION 01410

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Owner will allow each Contractor to use power and water, where available, for use in construction. All usage will be arranged for by the Construction Manager.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with the National Electric Code.
- B. Comply with federal, state and local codes and regulations and with utility company requirements.

1.03 MATERIALS, GENERAL

- A. Cords, connectors, etc. may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

1.04 TEMPORARY ELECTRICITY AND LIGHTING

- A. The Electrical Contractor shall furnish, install and maintain a complete and adequate temporary electrical service and distribution system for use by the Construction Manager and all Contractors during the construction period.
- B. The Electrical Contractor shall obtain, provide, and pay for all temporary electrical power service installation from the local power company or the existing building if the capacity is available.
- C. The cost of electrical power consumption shall be paid for by the Owner.
- D. Prior to the start of construction, the Electrical Contractor shall provide temporary power at each construction area and at the office of the Construction Manager. Each temporary service will be sufficient in size to provide continuous power for: twelve (12) ground fault protected, 20 amp, duplex receptables; two (2) 220v, 3 phase 40 amp receptable; 20 amp, 120v grounded temporary lighting circuits to provide for a minimum of one (1) lamp holder for each 200 square feet or a minimum of one (1) per room. Each lamp holder will be provided with one (1) 150 watt lamp and guard with no more than twelve (12) lamps per circuit. The Electrical Contractor shall be responsible for replacing all lamps as required.
- E. All wire and cable shall be sized to hold voltage drop at all outlets to a maximum of 5% total from transformer.
- F. Portions of the permanent electrical system may, at the option of the Electrical Contractor, be used for temporary power and lighting. The Electrical Contractor shall replace all burned out lamps, damaged wiring devices, and plates prior to acceptance of building by Owner. When any part of the permanent electrical system is used for temporary power or lighting, the Electrical Contractor will maintain the system until the final acceptance by the Owner and begin all warranties and guarantees upon the date of substantial completion.
- G. Overtime work requiring standby electricians shall be at the expense of the Contractor requiring the same.
- H. Installation of temporary electrical power and lighting shall be as scheduled by the Construction Manager.
- I. All temporary electrical installations shall be in compliance with the latest National Electrical Code (N.E.C.), MIOSHA or OSHA, whichever is more stringent. Compliance with N.E.C Section 210-8(b) shall be the responsibility of the Electrical Contractor. Assured grounding systems as defined in Exception Number 2 of N.E.C. Section 210-8(b) shall not be used in place of ground fault protection 9.

The Electrical Contractor shall completely remove the temporary electrical service and distribution system when directed to do so by the Construction Manager. The contractors responsible for the installation of all ceilings and partitions shall patch their work as necessary after removal of the temporary electrical system at no additional cost to the Construction Manager or Owner.

- J. The Owner shall pay for all electrical energy consumed during the construction period except for energy consumed to provide power or lighting in excess to those listed in this Article.
- K. Any electrical requirements for power or lighting beyond those listed in this Section (including energy charges) shall be the responsibility of the Contractor requiring them.

1.05 TELEPHONE SERVICE

- A. A telephone, if located at the Construction Manager's Field Office, may be provided for all Contractors' use in making local or long distance calls.

1.06 WATER

- A. A temporary water distribution center will be provided in a nearby convenient location. The Contractor shall supply all hoses, etc. beyond that point.

1.07 SANITARY FACILITIES

- A. The Construction Manager will arrange for temporary sanitary facilities. Contractors shall not use permanent facilities at the site.

1.08 TEMPORARY HEAT

- A. When identified and required by the H.V.A.C. Contractor's Bid Division Description, the H.V.A.C. contractor shall install a heating system (permanent or temporary) in readiness for furnishing temporary heat in the new structure.
- B. When the H.V.A.C. Contractor is required to provide a temporary heating system, the H.V.A.C. Contractor shall operate and maintain the temporary heating system. The temporary heating system shall maintain a minimum temperature at all times of 40 degrees during rough-ins and 60 degrees during finishing operations. The H.V.A.C. contractor shall be responsible for the costs of all temporary electrical work relating to the temporary heating system if the permanent system is not used.
- C. In the event that temporary gas fired or open flame heating devices are used, they shall be of the heat exchanger type properly vented to the outdoors, and shall comply with local and state laws, codes, and ordinances.
- D. Portions of the new heating system may, at the option of the H.V.A.C. contractor, be used for temporary heat providing that all parts of the system are cleaned and restored to prime condition prior to acceptance. The H.V.A.C. contractor shall remove any filters used during the temporary heating period and replace with new filters. In addition, the H.V.A.C. subcontractor shall pay the cost of extending warranty and guarantee periods on any permanent equipment used prior to Substantial Completion. The H.V.A.C. contractor shall completely remove the temporary heating system when directed to do so by the Construction Manager.
- E. When identified and required by the H.V.A.C. Contractor's Bid Division Description, all or portions of the new (permanent) H.V.A.C. system shall be used for temporary heat. When the new/permanent system is used for temporary heat, the H.V.A.C. Contractor shall:

1. Maintain the system throughout its use.
2. At the end of the system's use as a temporary system, the H.V.A.C. Contractor shall replace all filters with new filters.
3. Cover openings in permanent return air ductwork with filter media. Maintain and replace filter media as required so air flow is not restricted.
4. Clean and restore all parts of the system to prime condition immediately prior to final acceptance by the Owner.
5. Provide the full warranty and guarantee of the entire system with the warranty/ guarantee period beginning at the time of final acceptance by the Owner.

F. All fuel costs for Temporary Heat shall be paid fo by the Owner.

1.09 EXECUTION

A. Each Contractor shall maintain and operate systems to assure continuous service, and avoid disruption of service.

1.10 REMOVAL

- A. Each Contractor shall promptly remove their own temporary materials and equipment when their use is no longer required.
- B. Each Contractor shall clean and repair damage they have caused by temporary installations or use of temporary facilities.
- C. Each Contractor shall restore existing facilities they have used for temporary services to their specified or original condition.

END OF SECTION 01510

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Each Contractor shall furnish, install, and maintain construction aids required for the performance of their own Work, and shall move or remove them when they are no longer needed for the Work.
- B. Certain construction aids will be provided for and maintained by the Owner as indicated in later paragraphs in this Section.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used, shall be suitable for their intended purposes, and shall not violate the requirements of applicable codes and standards.

2.02 CONSTRUCTION AIDS

- A. Each Contractor shall provide all required construction aids and equipment to facilitate the execution of the Work, including scaffolds, staging, ladders, and other such facilities and equipment.
- B. Contractors shall maintain all facilities and equipment in a first-class condition.

2.03 TEMPORARY ENCLOSURES

- A. The Construction Manager will arrange for temporary enclosures except those required by section 01900 – 2.01 to separate work areas from the areas of existing buildings occupied by the Owner to prevent penetration of dust or moisture into occupied areas, to prevent damage to existing equipment, and to protect the Owner’s employees, customers, and operations from construction work.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Consult with the Owner, Construction Manager, and other Consultants and review the site conditions and other factors, which could affect construction procedures and construction aids, including adjacent properties and public facilities which may be affected by execution of the project.

3.02 GENERAL

- A. Comply with applicable requirements of the Specifications.
- B. Relocate construction aids as required by the progress of construction, by storage requirements, and to accommodate requirements of the Owner and other Contractors employed at the site.

3.03 REMOVAL

- A. Completely remove temporary materials, equipment, and services:
 - 1. When construction needs can be met by use of permanent construction.
 - 2. At the completion of the Project.
- B. Clean and repair damage to the permanent facilities caused by installation or by use of temporary facilities.
- C. Restore existing facilities used for temporary purposes to specified or original condition.

END OF SECTION 01520

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Safety is the responsibility of each individual Contractor. Each Contractor shall comply with all local safety ordinances and MIOSHA regulations and requirements while performing the Work.
- B. Each Contractor is required to submit Safety Data Sheets (SDS) to the Construction Manager via Procore or email, to be used for reference only, prior to transporting the material/chemical on site. In addition, it is the responsibility of each Contractor to maintain an accessible SDS file for their employees, subcontractors, sub-subcontractors, and suppliers that are on site.
- C. Each Contractor shall submit evidence of an Employer Safety Program that complies with current MIOSHA regulations and requirements prior to beginning any contract Work.
- D. Each Contractor and their Subcontractor(s), Sub-subcontractor(s), and Suppliers shall take all necessary precautions to ensure the safety of the public and/or workers on the job, and to prevent accidents or injury to any persons, on, about, or adjacent to the premises where the Work is being performed. The Contractor and their Subcontractor(s), Sub-subcontractor(s), and Supplier(s) shall comply with Federal or State OSHA regulations and all other laws, codes, ordinances, and regulations relative to safety and the prevention of accidents.
- E. The Contractor shall designate a responsible representative at the jobsite as Safety Representative who shall be responsible for the promotion of safety and prevention of accidents, and shall enforce all applicable laws, ordinances, codes, rules, regulations, and standards pertaining to safety and prevention of accidents.

END OF SECTION 01530

PART 1 – GENERAL

1.01 SECURITY

- A. Each Contractor shall bear full responsibility for protecting equipment, materials, and tools from damage, loss and vandalism.

END OF SECTION 01540

PART 1 – GENERAL

1.01 PROJECT ACCESS

- A. All employees of the Contractor(s), employees of the subcontractor(s) of the Contractor, any and all other persons having any related activity to the Contractor including suppliers & sales representatives, Inspectors, Architect/Engineer Representatives and all other Visitors must report to the Construction Manager Field Supervisor in the CM Site Office before being permitted into the project.
- B. Each worker must register at the site office prior to entering the work area each day that worker is engaged in the required tasks for the construction of the project. The worker shall register by signing their name and issued ID number, identify the company they represent. The supervising foreman for each Contractor shall be responsible for registering all employees or tier subcontractor employees of that Contractor each day and providing that registration to the CM Field Supervisor.
- C. If Owner requested, all workers will be issued a photo identification badge and corresponding number by the Construction Manager allowing them access to the project. The ID badge shall be worn at all times. Any person failing to wear the photo ID badge will be required to leave the project immediately.
- D. Only workers performing required tasks for the construction of the project will be permitted access to the project site. Workers not actively engaged in performing required tasks will not be permitted on the project.
- E. Suppliers, sales representatives and any other person having legitimate business with the Contractor or a subcontractor of any tier to the Contractor must remain at the Site Office until the on-site supervisor for that Contractor or tier subcontractor meets with that person at the CM Site Office.
- F. Any visitor to the project must register at the CM Site Office, request permission from the CM Site Supervisor for access to the project, have their own personal protection equipment as required by the CM Site Supervisor, and be issued a "Visitor" identification badge allowing access to the project.
- G. The CM Site Supervisor may deny any person access to the project for any reason the supervisor may see fit.
- H. The Contractor agrees to adhere to this Project Access policy regardless of all other agreements.

1.02 ACCESS ROADS

- A. Contractors' access to the Project site and arrangements for periodic, temporary access for specific construction shall be made through the Construction Manager with the Owner's approval.

1.03 DELIVERY

- A. Contractors receiving deliveries to site shall request a 24-hour notice to delivery from suppliers. Contractors receiving deliveries shall ensure that their personnel are at the site to receive deliveries, and properly store them.
- B. Bidders of Divisions for supply only shall give 48 hours' notice to the Field Construction Manager so proper arrangements can be made for unloading.
- C. Any Contractors or Bid Division suppliers not giving notice shall reimburse Contractors at the site or be back charged accordingly for unloading and storage of said materials.
- D. Since site space is limited, delivery of materials shall not be made to the jobsite before progress of the job schedule calls for it, unless approved by the Construction Manager.

1.04 PARKING

- A. Contractor parking will be in an area designated by the Construction Manager on site.

1.05 SITE PLAN

- A. Refer to the Contractors use of premises (Section 01010) for further information on the use of the site.

END OF SECTION 01550

PART 1 – GENERAL

1.01 CONTROLS

- A. Control of elements such as noise, dust, water, pests, rodents, debris, pollution, and erosion are the responsibility of the Contractor(s). The Architect and Construction Manager will identify the Contractor(s) responsible for these controls in the event such controls have not been implemented. The Contractor(s) agree to abide by the assignment of responsibility by the Architect and Construction Manager regarding such controls when required. The Contractor(s) shall be responsible to perform the control measures in strict conformance to all governing codes and restrictions.

END OF SECTION 01560

PART 1 – GENERAL

1.01 TRAFFIC REGULATIONS

- A. Contractors shall abide by all governmental and Owner-established traffic regulations.
- B. Contractors shall use the route designated by the Owner/Construction Manager and shall comply with the requirements of Section 01550 – Access and Deliveries.

END OF SECTION 01570

PART 1 – GENERAL

1.01 DESCRIPTION

- A. No signs shall be displayed by any Contractor.

END OF SECTION 01580

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Project Field Office will be located on-site adjacent to the location of the temporary power.
- B. The Project Field Office will be used by the Owner, Construction Manager, and Architect.
- C. Project meetings and progress meetings will be held in the Project Field Office, or at another location selected by the Construction Manager when deemed necessary.

1.02 TRAILERS, ETC.

- A. Trailers to be used as Contractors' site office and storage will be permitted. Approval must be obtained from the Field Construction Manager prior to moving on-site and will be located as directed by the Construction Manager. All trailers must meet federal, state, and local electrical and fire codes.

END OF SECTION 01590

PART 1 – GENERAL

1.01 NEW MATERIAL AND EQUIPMENT

- A. Material and equipment incorporated into the Work shall:
1. Conform to applicable specification and standards,
 2. Comply with sizes, makes, types, and qualities specified or as specifically approved in writing by the Architect or Owner.
- B. Manufactured and Fabricated Products:
1. Design, fabricate and assemble in accord with the best engineering and shop practices.
 2. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 3. Two or more items of the same kind shall be identical, by the same manufacturer.
 4. Products shall be suitable for service conditions.
 5. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically approved in writing by the Project Architect.
- C. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 MANUFACTURERS INSTRUCTIONS

- A. When the Contract Documents require that installation comply with manufacturers' printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two (2) copies to the Project Architect.
- B. Maintain one set of complete instructions at the site during installation, until project completion.
- C. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
1. Should job conditions or specified requirements conflict with manufacturers' instructions, consult with the Project Team for further instructions.
- D. Perform Work in accord with manufacturers' instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

1.03 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of products in accord with the Short Term Construction Activities Plan. Coordinate to avoid conflict with Work and conditions at the site.
1. Deliver products in undamaged condition, in manufacturers' original containers or packaging, and with identifying labels intact and legible.
 2. Immediately upon delivery, inspect shipments to assure compliance with the requirements of the Contract Documents and approved submittals, and to ensure that products are properly protected and undamaged.
- B. Provide equipment and personnel to handle products by methods, which will prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION

- A. Store products in accord with manufacturers' instructions, with seals and labels intact and legible.
 - 1. Store products subject to damage by the elements in weather tight enclosures.
 - 2. Maintain temperature and humidity within the ranges required by Manufacturers' instructions.
- B. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that the products are maintained under specific conditions, and are free from damage or deterioration.
- C. Protection after Installation:
 - 1. Provide substantial coverings as necessary to protect installed products from damage, traffic, and subsequent construction operations. Remove the coverings when they are no longer needed.

1.05 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. Products List:
 - 1. Before commencing Work, submit to the Construction Manager a complete list of major products proposed to be used, with manufacturers' and suppliers' names, product names, model numbers, and where applicable, names of installing subcontractors. (Refer to Section 00680.)
- B. Contractor's Options:
 - 1. For products specified only by reference standard, select any product meeting that standard.
 - 2. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications.
 - 3. For products specified by naming one or more products or manufacturer and "or equal," Contractors must submit requests for substitutions for any product or manufacturer not specifically names.
 - 4. For products specified by naming only one product and manufacturer, there is no option.
- C. Substitutions:
 - 1. The Project Team will consider written requests from Contractors for substitution of products.
 - 2. Submit a separate request for each product, supported with complete data, with drawings and samples, as appropriate, including:
 - a. Comparison of the qualities of the proposed substitution with that specified,
 - b. Changes required in other elements of the Work because of the substitution,
 - c. Effect on the construction schedule,
 - d. Cost data comparing the proposed substitution with the product specified,
 - e. Any required license fees or royalties,
 - f. Availability of maintenance service, and source of replacement materials.
 - 3. Architect will be the judge of the acceptability of all proposed substitutions.
 - 4. Any request for a substitution constitutes a representation that the Contractor:
 - a. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified,
 - b. Will provide the same warranties or bonds for the substitution as for the product specified,
 - c. Will coordinate the installation of accepted substitutions into the Work, and make such other Changes as may be required to make the Work complete in all respects,
 - d. Waivers all claims for additional costs which may subsequently become apparent.
 - 5. The Construction Manager will review requests for substitutions and the Architect's determination of acceptability with reasonable promptness, and will notify Contractors in writing of his decisions regarding requested substitutions.

END OF SECTION 01600

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Each Contractor shall comply with requirements stated in the General Conditions and in the Specifications for procedures in closing out the Work.

1.02 SUBSTANTIAL COMPLETION AND FINAL INSPECTION PROCEDURE

- A. When a Contractor's work is 98% complete, and in compliance with Section 10 "Completion" of the Contract, the Contractor will be provided with a Certificate of Substantial Completion, after proper certification by the Construction Manager and Architect. A list of Work in need of correction and a list of incomplete Work will be forwarded to the Contractor. Both the Construction Manager and the Architect will have input to each list.
- B. Each Contractor will be allowed two weeks to complete the items on both lists beginning from the date stipulated on the Certification of Substantial Completion. The Contractor shall begin completion and correction activities within seven (7) days of receipt of the lists and complete all activities within the two weeks period specified. Contractors failing to perform in accord with these time parameters will be subject to the provisions of the Additional Conditions, and the Owner will have the right to carry out the corrective Work and/or complete the Work. The cost of correction or completion will be deducted from the Contractor's contract amount.
- C. By the act of submitting the Certificate of Substantial Completion for execution by the Construction Manager and the Architect, the Contractor represents that they have:
1. Reviewed the Contract Documents.
 2. Inspected their Work for compliance with the Contract Documents.
 3. Completed their Work in accord with the Contract Documents and all pertinent submittals.
- D. They further represent that:
1. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 2. Their Work is completed and ready for final inspection.

1.03 CONTRACTOR'S CLOSEOUT DOCUMENTS

- A. Upon Substantial Completion, the Contractor shall submit the following:
1. Evidence of compliance with requirements of governing authorities, including Certificates of Inspection.
 2. Operating and Maintenance Data, Product Data and Instructions to the Owner's personnel.
 3. Warranties and Bonds
 4. Spare Parts and Maintenance Materials
 5. Evidence of Payment and Release of Liens
 6. Certification of Substantial Completion.
 7. As Built Drawings
 8. Contractor Hazardous Materials Compliance Affidavit
 9. Asbestos Free Affidavit
 10. Letter from Contractor's Insurance carrier that a Certificate of Insurance shall be sent to the Construction Manager at renewal time for a two (2) year period after substantial completion.
- B. One (1) hard copy set along with one (1) electronic set of close out documents shall be submitted to the Construction Manager upon Substantial Completion.

- C. All Close Out documents must be turned in within two weeks of substantial completion. Final payment to the contractor will not be released until all close out documents have been received and approved and/or punch list items have been completed and signed off.

1.04 FINAL APPLICATION FOR PAYMENT

- A. Each Contractor shall submit the final Application for Payment in accord with the procedures and requirements stated in the General Conditions of the Contract for Construction.
- B. Refer to Sections 01720, 01730, and 01740 for further information regarding submittals.

END OF SECTION 01700

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Each Contractor shall execute cleaning during the progress of the Work, and at completion of the Work, as required by the Additional Conditions and the Specifications.

1.02 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operation to comply with codes, ordinances, regulation, and anti-pollution law.

PART 2 – PRODUCTS AND EQUIPMENT

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property, and which, will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.
- D. Each Contractor shall provide his/her own cleaning equipment.
- E. Each Contractor shall cooperate with the Owner and the Construction Manager regarding clean up.

PART 3 – EXECUTION

3.01 HOUSEKEEPING AND CLEAN-UP

- A. Each Contractor shall execute daily housekeeping to keep their Work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris resulting from construction operations.
- B. Each Contractor is financially responsible for his/her clean-up operations. Clean up must be timely as well as thorough in order to meet safety regulations and permit other Contractors to perform without hindrance from dirt and debris. The Construction Manager will coordinate Project housekeeping and take appropriate steps to maintain clean, safe working conditions. **Contractors failing to meet housekeeping requirements will be charged for services arranged by the Construction Manager.**

3.02 DUST CONTROL

- A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
- C. Clean up must be performed after each task is done.
- D. Each Contractor is responsible for developing a plan for dust control and debris removal for each task prior to starting.

3.03 FINAL CLEANING

- A. Each Contractor shall employ qualified persons for cleaning.
- B. Installing Contractors shall remove grease, mastic adhesives, dust, dirt, stains, finger-paints, labels, and other foreign materials from exposed interior and exterior surfaces, for acceptance by the Construction Manager, prior to leaving the site.
- C. Prior to final completion or Owner occupancy, each Contractor shall conduct an inspection of exposed interior and exterior surfaces and all work areas, to verify that the entire Project is clean.

END OF SECTION 01710

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Construction Manager will make available a set of Record Documents of the following:
1. Drawings.
 2. Specifications.
 3. Addenda.
 4. Change Orders and other Modifications to the Contracts.
 5. Written Instructions.
 6. Approved Shop Drawings, Product Data and Samples.
 7. Field Test Records.
 8. Construction Photographs.

1.02 RECORD DRAWINGS

- A. As a condition of final payment, each Contractor shall mark any and all installation information that differs in location, size, dimension or type from that shown on the Construction Documents on a single set of Construction Documents. Location of items of work such as electrical conduits, junction boxes, fire alarm cable, data cable, etc., that are not specifically shown on the Construction Documents shall be included in the Record Drawings. Locations of all work installed under concrete slabs shall be noted with accurate dimensions and the depth below finish floor indicated.

1.03 SUBMITTAL

- A. At Contract Closeout, each Contractor shall deliver one (1) hard set along with (1) electronic set of Record Documents, as indicated in 01700.1.03B to the Construction Manager, for delivery to the Owner.
- B. Each Contractor shall accompany their Record Document submittal with a transmittal letter in duplicate, containing:
1. Date.
 2. Project and Phase designation.
 3. Contractor's name and address.
 4. Bid Division name and number
 5. Title and number of each Record Document.
 6. Signature of Contractor of his authorized representative.
- D. The receipt of such Record Documents by the Construction Manager or the Owner shall not be a waiver of any deviations from the Contract Documents.

END OF SECTION 01720

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Each Contractor shall compile product, data, and related information appropriate to the Owner's maintenance and operation of products furnished under their contract.
- B. Each Contractor shall instruct the Owner's personnel in the maintenance of products and in the operation of equipment and systems.

1.02 MAINTENANCE AND OPERATING MANUALS

- A. Prior to Substantial Completion, each Contractor shall submit to the Construction Manager one (1) hard set along with one (1) electronic set of all comprehensive maintenance and operating materials, presenting complete directions and recommendations for the proper care and maintenance of all visible surfaces, as well as maintenance and operating instructions for all equipment items which the Contractor has provided or installed.
- B. Operating instructions shall include all necessary printed directions for correct operation, adjustment, servicing, and maintenance of movable parts. Also included shall be suitable parts lists and diagrams showing parts location and assembly.

1.03 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection or acceptance, each Contractor shall fully instruct the Owner's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment, and systems.
- B. Manufacturer's operating and maintenance manuals shall constitute the basis of instruction. Each Contractor shall review the contents of such manuals with the Owner's personnel in full detail to explain all aspects of operation and maintenance.

END OF SECTION 01730

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Contractor shall provide a written Guarantee for all labor, material, equipment and workmanship for a minimum period of two (2) years from the date of Substantial Completion of the project (or longer period of time if stipulated in the specifications) covering the work of their entire Bid Division(s).
- B. The Contractor shall also provide a written Warranty covering all work of their entire Bid Division(s) for a minimum period of two (2) years from the date of final project completion (or longer period of time if stipulated in the specifications).
- C. The Contractor shall further provide all supplier, manufacturer, subcontractor and other written guaranties and warranties covering the work of the entire Bid Division(s) as required by the project specifications.

1.02 REQUIREMENTS

- A. The Contractor shall provide one (1) hard copy along with one (1) electronic copy of all written Guaranties and Warranties.
- B. The Contractor shall review all guaranties and warranties to assure of their compliance with all conditions of the contract.
- C. The Contractor shall assemble all guaranties and warranties, fully executed by each respective contractor, supplier, manufacturer and subcontractor and submit to the construction manager within two weeks of the date of Substantial Completion of the project.
- D. If the Owner elects to permit equipment and component parts of equipment into service during the progress of construction and has issues such permission in writing, all such guaranties and warranties must be submitted to the construction manager within two weeks after inspection and acceptance.
- E. For items of work where acceptance is delayed materially beyond the Date of Substantial Completion, the Contractor shall provide revised guaranties and warranties listing the acceptance date as the start of the guaranty or warranty period.

END OF SECTION 01740

PART 1 – GENERAL

1.01 DESCRIPTION

- A. It shall be the Contractor's responsibility to ensure that the Owner is notified of any hazardous materials brought to the site.
- B. In compliance with Michigan State Law there is to be no smoking anywhere on the project site or owner's property or use of any tobacco product at any time.
- C. The Contractor agrees to disallow any known carcinogens to be brought onto the jobsite at any time.
- D. The Contractor will not permit any employee to be in possession of any firearm or ammunition when on school property either on the worker's person or in the worker's vehicle. It is illegal to possess firearms or ammunition on your person or in a vehicle on school property at any time.

1.02 REQUIREMENTS

- A. The Contractor shall provide:
 - 1. One (1) hard copy of each Safety Data Sheet (SDS) for each of the hazardous materials used on the site.
 - 2. Certification that the Contractor (and their subcontractors) has instructed the persons using the hazardous materials in their proper use.
 - 3. For removal of any unused hazardous materials in their proper use.
 - 4. Certification that no asbestos containing materials are being used or brought onto the site by signing and notarizing the asbestos free certificate, which follows as page 3 of this Section.
- B. The Contractor shall utilize employee(s) that have been trained and certified for Hazardous Material Awareness specifically for asbestos and lead awareness.
- C. The Contractor has the responsibility to make themselves, their employees, and their subcontractors aware of any hazardous materials in the area of their specified work.
- D. The above requirements must be fulfilled, in writing, at or prior to a pre-construction meeting by filling out the Contractor Hazardous Materials Compliance Form, which is page 2 of this section.
- E. Standard safety practices and regulations as supplied by all governmental agencies will be in effect.
- F. A list of district SDS sheets is available on request.
- G. The Contractor shall submit a completed Contractor Hazardous Materials Compliance Affidavit and Asbestos-Free Affidavit certifying that no hazardous material has been incorporated into the Project as part of the documentation for Contract Close-Out.

2.01 COMPLIANCE

- A. Compliance with EPA AHERA for Asbestos.
 - 1. The Contractor must adhere to all EPA AHERA and Michigan State Asbestos Regulations for asbestos and other hazardous materials.

B. Compliance with Lead-Containing Materials.

1. All Contractors, Subcontractors and Sub-subcontractors shall adhere to the Environmental Protection Agency (EPA) lead-based paint regulation titled the "Renovation, Repair and Painting (RRP) Rule". Included under this law are "Child Occupied Facilities" (COFs). COFs encompass locations of a pre-1978 constructed buildings where children under age of six (6) regularly visit, such as kindergarten rooms, 1st grade classrooms, applicable restrooms, preschools and day care centers. Therefore portions of each pre-1978 constructed school building falls under the RRP Rule.
2. Any contractor working on this project who disturbs painted surfaces in COF spaces shall ensure that they adhere to all aspects of the RRP Rule. This includes but is not limited to meeting the requirements for being a Certified Firm, having a Certified Lead Renovator involved and following applicable lead safe work practices.
3. Furthermore, all Contractors shall be responsible to comply with all applicable Federal and Michigan State lead regulations including, but not limited to, 29 CFR Part 1926.62 of the OSHA Lead Construction Standard, (Part 603 of the Michigan State Standards). All costs associated with regulatory compliance shall be borne by the Contractor.

CONTRACTOR HAZARDOUS MATERIALS COMPLIANCE AFFIDAVIT

PROJECT NAME: _____

TITLE: _____

Contractor: _____

Address: _____

Contractor's Representative: _____

Phone: _____ Fax: _____

Job Location: _____

This document certifies that the Contractor and any subsequent Contractors have complied with the terms set forth in the requirements for **Hemlock Public Schools** as they pertain to hazardous materials.

The SDS's are attached for all hazardous materials which will be brought to **Hemlock Public Schools**.

There are _____ SDS's attached.

The Contractor's employees (including subcontractors) have received appropriate instructions pertaining to the use and handling of hazardous materials.

The Contractor has been informed of hazardous materials in the area of the specified work.

Signature of Contractor's Representative

Date: _____

Received by: _____

Date: _____

ASBESTOS FREE AFFIDAVIT

Contractor: _____

Company Name: _____

Street: _____ City: _____ State: _____ Zip: _____

Project: _____

Bid Division: _____

Name of Building(s) in which work was performed:

Certificate Statement:

I _____, representing and having authority for

_____, hereby certify that any and all products/materials

that will be or have been installed/introduced in the above mentioned buildings, are asbestos free or less

that one percent (1%) asbestos by weight.

Name (printed): _____ Position: _____

Signature: _____

Date: _____

Notary Public: _____

My Commission Expires: _____

END OF SECTION 01800

PART 1 – GENERAL

1.01 NOTICE

- A. This notice is to formally advise you, per AHERA Requirements, that all buildings may have asbestos containing materials present. All areas testing positive for asbestos are documented in booklets located in the **Hemlock Public Schools**.

1.02 DESCRIPTION

- A. All thermal insulation such as pipe wrap, especially joints, should be assumed to contain asbestos. Contractors are cautioned not to attempt removal of these materials without first notifying the Owner.

AHERA Notification and Contractor Compliance Affidavit

Project Name: Hemlock Public Schools – Bid Package #1
Project #: A22913
Owner: Hemlock Public Schools
Address: 200 Wilson St, Hemlock, MI 48626

This notice is to formally advise you, per AHERA Requirements, that all buildings may have existing asbestos containing materials. All areas testing positive for asbestos have been documented in the owner’s asbestos inspection report available for inspection at the owner’s main office. All areas currently testing positive for asbestos are documented in the attached Three-Year Re-Inspection Asbestos plan report that has been provided by: Hemlock Public Schools.

All thermal insulation such as pipe wrap, especially joints, should be assumed to contain asbestos. Contractors are cautioned not to attempt removal of these materials without first notifying the Owner.

I / We _____ doing business as _____ acknowledge receipt of the Three Year Re-Inspection Asbestos plan for the above mentioned project(s) as provided by Hemlock Public Schools and certify that all employees of this contractor shall have been trained in the MIOSHA Two-Hour Asbestos Awareness program. It is this Contractor’s responsibility to inform any subcontractors or suppliers of this information and assume all responsibility for such notification.

Company

Name

Title

Address

City, State, Zip

State of _____ County of _____

Subscribed and sworn to before me this _____

day of _____

Notary Public: _____

My Commission Expires: _____

Seal

END OF SECTION 01805

THREE YEAR ASBESTOS REINSPECTION

**HEMLOCK PUBLIC SCHOOLS
1095 N Hemlock Rd
Hemlock , MI. 48626**

July 12 2022

Designated Person - Mr. Ric Crofoot



Fortress Environmental

**Fortress Environmental Solutions, LLC
649 Busha Road
Owosso, MI 48867
800.526.2569**

HEMLOCK PUBLIC SCHOOLS
1095 N Hemlock Rd
Hemlock , MI. 48626

REINSPECTION REPORT COVER PAGE

Designated Person - Mr. Ric Crofoot
Office - (989) 642-8950

The following reinspection was conducted by Jim Rose. The inspector was responsible for all reinspection data generation and ACM assessments. Data for this report was based on information collected and assembled by another firm.

Building

Hemlock High School
Hemlock Middle School
Ling Elementary
Hemlock Elementary
Transportation Building

As the inspector, I have examined and assessed all ACM materials identified in the initial Inspection Report. My responsibility is to provide the documentation for the assessments of the ACM. It is the responsibility of the LEA to provide documentation for New Materials and for ongoing AHERA Record Keeping (Abatement, training, surveillance and fiber release, etc.).

All quantifications are approximate. No additional cleaning was required of ACM unless such is indicated in the management plan. No foreseeable potential damage is anticipated unless otherwise indicated in this report. An asterisk in the report indicates that the condition of the ACM has changed or the material was not previously identified in the initial report. Within this report, if there is no item of Thermal System Insulation, Surfacing Material, or Miscellaneous Material within a building or area, this indicates that no ACM item was listed in the initial report. As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated.



Signature - AHERA Inspector - Jim Rose
Accreditation #A6837 - Michigan Department of Public Health

Hemlock High School

Building Note: As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated. Original AHERA inspection Homogeneous Areas are listed in parenthesis on the top line of each item. Note, that there may be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

Removed Material Since Last Reinspection:

Grey Floor Tile and Mastic in 1959 Section – Approximately 21356 sq ft is ACM, non-friable, much under carpet and located throughout this section. **Beige Floor Tile and Mastic** in Auditorium – Approximately 600 sq ft is ACM, non-friable, much under carpet and located throughout this section.

Elbows – Approximately 15 from tunnel under auto shop

THERMAL SYSTEM INSULATION

Mag Pipe Insulation (Material #22) 6335 In ft is ACM, friable with a non-friable jacket. It was tested by school: 10% to 70% Chrysotile located in main tunnel, classroom univents (inside enclosure), mechanical room, pipechases:

Mudded Pipe Fitting on Mag Lines (Material #23) 804 are ACM, friable with a non-friable jacket. It was tested by school: 10% to 70% Chrysotile located in main tunnel, classroom univents (inside enclosure), mechanical room, pipechases.

Mudded Pipe Fitting on Fiberglass Lines (Material #42) 817 are ACM, friable with a non-friable jacket. It was tested by school: 10% to 20% Chrysotile located in air handler rooms, locker rooms, gym lobby, teachers lounge,

Air Cell Pipe Insulation (Material #58) 897 In is is ACM, friable with a non-friable jacket. It was tested by school: 5% Chrysotile located in main tunnel.

Mudded Pipe Fitting on Aircell (Material #59) 162 are ACM, friable with a non-friable jacket. It was tested by school: 5% Chrysotile located in main tunnel:

Mudded Pipe Fitting on Fiberglass Lines (Material #62) 46 are ACM with a non-friable jacket. Note: fittings located in wood shop tunnel were tested and found to be <1% Chrysotile while others in the building are 5% Chrysotile. Before disturbing any of these materials we recommend further testing.

Brick Inside Incinerator – 220 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Material Inside Boiler – 2 Boilers contain Assumed ACM, non-friable. Materials must be tested before disturbance.

SURFACING MATERIAL

None listed in previous reports

MISCELLANEOUS MATERIAL

Fire Door Caulk and Frames (HA 60) 145 are Assumed ACM, non-friable. Material must be tested before disturbance.

Fire Doors 81 are Assumed ACM, non-friable. Material must be tested before disturbance.

Transite Panels under Stucco 930 sq ft is Assumed ACM non-friable located on exterior of building. Material must be tested before disturbance.

Transite Chalkboard and Glue 112 sq ft is Assumed ACM non-friable. Material must be tested before disturbance.

Transite Window Panels (HA 62) –458 sq ft Assumed ACM, non-friable located above windows throughout building. Material was tested by school: 20% Chrysotile

Tar/Mastic/Felt Under Gym Floor – Approximately 9334 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Black Sink Undercoating – 1 Sink is ACM, non-friable. The material was tested by the school: 4% Chrysotile.

White Floor Tile and Mastic in 1959 Section – Approximately 427 sq ft is ACM, non-friable, much under carpet and located throughout this section.

Green Floor Tile and Mastic in 1959 Section – Approximately 67 sq ft is ACM, non-friable.

**FIRE DOORS, GASKETS, CAULK AND FIREBRICK WHERE FOUND
ARE ASSUMED ACM, NON-FRIABLE UNLESS OTHERWISE STATED**

Hemlock Middle School

Building Note: As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated. Original AHERA inspection Homogeneous Areas are listed in parenthesis on the top line of each item. Note, that there may be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

Items Removed Since Previous Reinspection: Water Storage Tank Insulation (HA9) – Approximately 321 sq ft located in boiler room is friable ACM with a non-friable jacket.
Transite Window Blanks (HA 34) Unspecified quantity is Assumed ACM, non-friable.
Flooring and mastic Approximately 4000 sq ft from Rooms 18,23,24,25 is Assumed ACM, non-friable.

THERMAL SYSTEM INSULATION

Elbows and Joints – Approximately 25 above ceilings in hallway and in custodial closet are assumed ACM, friable with a non-friable jacket.

Note: These had been excluded from many reinspection reports because they were thought to have been tested and found to be negative. Further investigation has not been able to retrieve documentation for this testing so we have put them back in the reports as assumed, ACM.

SURFACING MATERIAL

None listed in previous reports.

MISCELLANEOUS MATERIAL

Flooring and Mastic Previous data had assumed all flooring. There is now approximately 48467 sq ft remaining.

Fire Doors and Frames (HA 30) 19 are Assumed ACM, non-friable. See original report for locations.

Door Frame Caulk (HA 31) 426 In ft is non-friable. Material was tested by school: <1% Chrysotile.

Window Frame Caulk (HA 32) 652 In ft is non-friable. Material was tested by school: .

Window Frame Glazing 668 In ft is non-friable. Material was tested by school: 2% Chrysotile.

Glue Pods Behind Visual Display Boards (HA 33) 3,266 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Tar/Mastic/felt under hardwood gym floor 7875 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Black wrap on roof top duct work. 264 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Spray on Fireproofing. 7875 sq ft is Assumed ACM, non-friable. Material must be tested before disturbance.

Black Sink Undercoating. 1 Sink is Non-friable ACM. Material was tested by school: 3% Chrysotile.

Gray Sink Undercoating 5 Sinks are Non-friable ACM. Material was tested by school: 3% Chrysotile.

**FIRE DOORS, GASKETS, CAULK AND FIREBRICK WHERE FOUND
ARE ASSUMED ACM, NON-FRIABLEE UNLESS OTHERWISE STATED**

Ling Elementary School

Building Note: As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated. Original AHERA inspection Homogeneous Areas are listed in parenthesis on the top line of each item. Note, that there may be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

NOTE: Duct Board (HA 14) Unspecified quantity Assumed ACM in previous reports, non-friable located in rooftop HVAC units was tested by school and there is non-detected.

REMOVED MATERIAL: Approximately 100 In ft of fittings are ACM, friable with a non-friable surface located above ceilings. These have been removed.

THERMAL SYSTEM INSULATION

Elbows and Joints – Approximately 25 remaining above ceilings in hallway and in maintenance areas are assumed ACM, friable with a non-friable jacket.

Note: These had been excluded from many reinspection reports because they were thought to have been tested and found to be negative. Further investigation has not been able to retrieve documentation for this testing so we have put them back in the reports as assumed, ACM.

SURFACING MATERIAL

None listed in previous reports.

MISCELLANEOUS MATERIALS

Transite Panel Under Decorative Stone Approximately 2456 sq ft is ACM, non-friable located on exterior fascia of building. Material was tested by school: 20% Chrysotile.

Floor Tile and Mastic Under Carpet Approximately 40367 sq ft is Assumed ACM, non-friable. Most is under carpet. Material must be tested before disturbance.

Caulk on Exterior Wood Window Frame Approximately 84 In ft is ACM, non-friable. It was tested by school: 3% Chrysotile.

Fire Doors 106 are Assumed ACM, non-friable. Material must be tested before disturbance.

Pink Sink Undercoating 2 Sinks are ACM, non-friable. It was tested by school: <1% Chrysotile.

Floor Tile and Mastic (Multicolor Streaks) 7582 sq ft is non-friable. None detected in tile but 2% Chrysotile in mastic.

Floor Tile and Mastic (Tan with White Streaks) 123 sq ft is non-friable. None detected in tile but 3% Chrysotile in mastic.

Floor Tile and Mastic (Tan with Brown and White Streaks) 656 sq ft is non-friable. None detected in tile but 3% Chrysotile in mastic.

Caulk on Exterior Metal Door Frame 450 In ft is ACM non-friable. It was tested by school: 4% Chrysotile.

Caulk on Exterior Metal Door/Window Transom 300 In ft is ACM non-friable. It was tested by school: 4% Chrysotile.

Hemlock Old Elementary School

Building Note: As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated. Original AHERA inspection Homogeneous Areas are listed in parenthesis on the top line of each item. Note, that there may be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

There may also be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

Building Note:

Though this building has undergone asbestos removal activities which show no ACM remaining, recent testing by the LEA indicated the following areas:

Fire Doors – 57 doors are Assumed ACM, non-friable. Material must be tested before disturbance.

Dark Brown Glue Pods – 20 sq ft above drop ceiling in office area is ACM, non-friable. . It was tested by school: 2% Chrysotile.

Caulk on Glass Block Window Frames – Approximately 260 In ft located above ceilings in classrooms is ACM, non-friable. It was tested by school: 2% Chrysotile.

Transportation Building

Building Note: As detailed under AHERA regulations, data for this reinspection was gathered from previous inspections conducted by another company and only those items listed in previous inspections and reinspections were evaluated. Original AHERA inspection Homogeneous Areas are listed in parenthesis on the top line of each item. Note, that there may be hidden or inaccessible suspect materials remaining in walls, closets, beneath floors, in attics, pipechases or crawlspaces. Therefore, in the event suspect materials are exposed or discovered, they must be treated as ACM.

Caulk on Exterior Metal Door Frame Approximately 230 In ft is ACM, non-friable. It was tested by the school: 3% Chrysotile.

Fire Doors – Approximately 35 doors are Assumed ACM, non-friable. Material must be tested before disturbance.

Drywall and Joint Compound – Approximately 1995 sq ft is <1% Chrysotile ACM, non-friable.

Floor Tile and Mastic (Off white and tan streaks) – Approximately 328 sq ft is ACM, non-friable. It was tested by school: 2% Chrysotile in tile as well as mastic.

Floor Tile and Mastic Under Carpet – Approximately 3176 sq ft located under carpet is Assumed ACM. Material must be tested before disturbance.

Floor Tile and Mastic (Light Blue with Dark Blue Flex) – Approximately 641 sq ft is ACM, non-friable. It was tested by school: None detected in tile, 2% Chrysotile in Mastic.

Pink Sink Undercoating 3 Sinks are ACM, non-friable. It was tested by school. 4% Chrysotile.



Fortress Environmental

**Fortress Environmental Solutions
649 Busha Road
Owosso, MI 48867
800.526.2569**

Management Planner Report

The following report contains response actions which you as a Designated Person must consider. Quantifications and identifications of ACM or assumed ACM were derived from the initial inspection report. The following recommendations were determined from the EPA Tree (Form 90Bb) and AHERA. We have provided you with a convenient format below for you to mark your decisions. For those situations in which you would decide to take a more aggressive approach (i.e. removal) or for those recommendations with which you would disagree, please mark the appropriate box and provide in writing an explanation within 10 days.

Please note that no additional cleaning of friable ACM has been required except as noted below. All materials that are listed in the re-inspection report but not listed in this management plan report are to be maintained under your O & M plan. The response action listed may begin immediately, but is to be completed by the date listed in this report.

Because of the non-friable condition of materials, there were no new recommendations for the following buildings:

**Hemlock High School
Hemlock Middle School
Ling Elementary
Old Elementary
Transportation Building**

Additional Comments: There may be unknown and unidentified ACM located behind barriers. It is our recommendation to have your Designated Person on the site when demolition occurs.

I, as the Designated Person, have read the recommendations, checked the appropriate boxes and responded accordingly as indicated in our opening paragraph.

Mr. Ric Crofoot
Designated Person

Certificate Number: 247035 - 31580

ETC Training Services Group

38900 W. Huron River Drive, Romulus, MI 48174-1159

(734) 955-6600

PRESENTS

James Rose

SSN: ***.**-2060

649 Busha Road, Owosso, MI 48867

with certification for having successfully completed the 4 Hours which meets the requirements for

Asbestos Management Planner Refresher Virtual Training Course

Complying with the requirements of MI Public Act 440 of 1988 as amended, OSHA 29 CFR 1926.1101 & 40 CFR Part 763 (AHERA) as required under Title II of the Toxic Substance Control Act (TSCA)

Course date: May 19, 2022

Expiration Date: May 19, 2023



Trainer



ETC President

Certificate Number: 247028 - 31575

ETC Training Services Group

38900 W. Huron River Drive, Romulus, MI 48174-1159

(734) 955-6600

PRESENTS

James Rose

649 Busha Road, Owosso, MI 48867

with certification for having successfully completed the 4 Hours which meets the requirements for

Asbestos Inspector Refresher Virtual Training Course

Complying with the requirements of MI Public Act 440 of 1988 as amended, OSHA 29 CFR 1926.1101 & 40 CFR Part 763 (AHERA) as required under Title II of the Toxic Substance Control Act (TSCA)

Course date: May 19, 2022

Expiration date: May 19, 2023



Trainer



ETC President

PART 1 – GENERAL

1.01 CODES

- A. All work shall comply with the applicable requirements of the local building code and accident and fire prevention regulations.

1.02 SCOPE

- A. The Work covered by this section of Specifications includes, but is not limited to, the following:
1. Demolish and remove existing materials as shown on the plan and noted in the Description of Work.
 2. Cover holes and other hazardous openings with approved materials and barriers.
 3. Remove all demolition materials and debris from the construction site and dispose of in a legal manner.
 4. Protect adequately the construction site, adjoining property, and utility services as work proceeds through all stages.

1.03 QUALITY ASSURANCE

- A. Contractor's staff responsible for demolition shall be experienced in this type of work. Equipment is to be of suitable type, in good working condition, and operated by skilled mechanics.

PART 2 – PRODUCTS

2.01 TEMPORARY ENCLOSURES

- A. Provide temporary enclosures to prevent dust from entering other parts of the facility during demolition. Furnish, install and remove when directed, temporary weathertight enclosures in all exterior openings created during demolition by the contractor.

PART 3 – EXECUTION

3.01 GENERAL INSTRUCTIONS

- A. All work shall be done in a safe and cautious manner in order to avoid accidents and property damage.
- B. Protect the work scheduled to remain, and if damaged, repair to match existing work.
- C. All salvaged material unless otherwise noted on plans or in the Description of Work shall become the property of the Contractor and shall be evaluated in the Contractor's bid price. Promptly remove salvaged material from the construction site as the work proceeds.
- D. Carefully dismantle and store on site all material scheduled to remain the Property of the Owner. Protect until removed by the Owner or until end of Contract.
- E. Protect from damage and clean materials scheduled to be reused.
- F. Protect parts of the existing Work scheduled to remain. Cut away carefully the parts to be demolished to reduce the amount of necessary repairs.
- G. Support existing structure as needed during cutting of new openings or replacement of structural members.
- H. Prevent accumulation of debris and overloading of any part of the structure.
- I. Prevent access of unauthorized persons to partly demolished areas.
- J. Remove all demolition materials, debris, and rubbish from the site as soon as practicable. Do not permit any accumulation on the site. Transport all demolition materials without spillage on the streets.

END OF SECTION 001900

Refer to Construction Manager's Project Manual issued by Construction Manager for additional procurement, contracting, and general requirements

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

- 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES
- 00 3100 - AVAILABLE PROJECT INFORMATION
- 00 4325 - SUBSTITUTION DURING PROCUREMENT REQUEST FORM
- 00 6323 - CADD FILE TRANSFER WAIVER
- 00 6324 - BIM TRANSFER WAIVER
- 00 6325 - SUBSTITUTION DURING CONSTRUCTION REQUEST FORM

DIVISION 01 — GENERAL REQUIREMENTS

- 01 2300 - ALTERNATES
- 01 5639 - TEMPORARY TREE AND PLANT PROTECTION
- 01 6000 - PRODUCT REQUIREMENTS

DIVISION 02 — EXISTING CONDITIONS

- 02 4119 - SELECTIVE DEMOLITION

DIVISION 03 — CONCRETE

- 03 3000 - CAST-IN-PLACE CONCRETE
- 03 5416 - HYDRAULIC CEMENT UNDERLAYMENT
- 03 6000 - POST INSTALLED ANCHORS

DIVISION 04 — MASONRY

- 04 2000 - UNIT MASONRY

DIVISION 05 — METALS

- 05 1200 - STRUCTURAL STEEL FRAMING
- 05 3100 - STEEL DECKING
- 05 5000 - METAL FABRICATIONS
- 05 5213 - PIPE AND TUBE RAILINGS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

- 06 1000 - ROUGH CARPENTRY
- 06 4116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS
- 06 6400 - PLASTIC PANELING

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

- 07 4293 - SOFFIT PANELS
- 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING
- 07 6200 - SHEET METAL FLASHING AND TRIM
- 07 7100 - ROOF SPECIALTIES
- 07 8413 - PENETRATION FIRESTOPPING
- 07 8443 - JOINT FIRESTOPPING
- 07 9200 - JOINT SEALANTS
- 07 9219 - ACOUSTICAL JOINT SEALANTS

DIVISION 08 — OPENINGS

- 08 3323 - OVERHEAD COILING DOORS

DIVISION 09 — FINISHES

- 09 2216 - NON-STRUCTURAL METAL FRAMING
- 09 2900 - GYPSUM BOARD
- 09 5113 - ACOUSTICAL PANEL CEILINGS
- 09 6500 - RESILIENT FLOORING
- 09 6513 - RESILIENT BASE AND ACCESSORIES
- 09 6566 - RESILIENT ATHLETIC FLOORING
- 09 8433 - SOUND-ABSORBING WALL UNITS
- 09 9123 - INTERIOR PAINTING
- 09 9600 - HIGH-PERFORMANCE COATINGS

DIVISION 10 — SPECIALTIES

- 10 1426 - POST AND PANEL PYLON SIGNAGE
- 10 1453 - TRAFFIC SIGNAGE

DIVISION 11 — EQUIPMENT

- 11 6800 - PLAY FIELD EQUIPMENT AND STRUCTURES

DIVISION 12 — FURNISHINGS

- 12 3623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

DIVISION 22 — PLUMBING

- 22 0500 - COMMON WORK RESULTS FOR PLUMBING
- 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
- 22 0519 - METERS AND GAGES FOR PLUMBING PIPING
- 22 0523 - GENERAL DUTY VALVES FOR PLUMBING PIPING
- 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 0700 - PLUMBING INSULATION
22 1116 - DOMESTIC WATER PIPING
22 1119 - DOMESTIC WATER PIPING SPECIALTIES
22 1123 - DOMESTIC WATER PUMPS
22 1313 - FACILITY SANITARY SEWERS
22 3450 - DOMESTIC WATER HEATERS
22 4000 - PLUMBING FIXTURES

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

23 0500 - COMMON WORK RESULTS FOR HVAC
23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
23 0519 - METERS AND GAGES FOR HVAC PIPING
23 0523 - GENERAL DUTY VALVES FOR HVAC PIPING
23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 0700 - HVAC INSULATION
23 0900 - INSTRUMENTATION AND CONTROL FOR HVAC
23 1123 - FACILITY NATURAL GAS PIPING
23 2113 - HYDRONIC PIPING
23 2123 - HYDRONIC PUMPS
23 2500 - HVAC WATER TREATMENT
23 3113 - METAL DUCTS
23 3300 - AIR DUCT ACCESSORIES
23 3723 - HVAC GRAVITY VENTILATORS
23 8223 - UNIT VENTILATORS

DIVISION 26 — ELECTRICAL

26 0500 - COMMON WORK RESULTS FOR ELECTRICAL
26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 0800 - MINIMUM COMMISSIONING OF ELECTRICAL SYSTEMS
26 0923 - LIGHTING CONTROL DEVICES
26 0943 - LIGHTING CONTROL SYSTEM
26 2726 - WIRING DEVICES
26 5100 - INTERIOR LIGHTING
26 5600 - EXTERIOR LIGHTING

DIVISION 31 — EARTHWORK

31 1000 - SITE CLEARING

31 2000 - EARTH MOVING
31 2319 - DEWATERING

DIVISION 32 — EXTERIOR IMPROVEMENTS

32 1216 - ASPHALT PAVING
32 1313 - CONCRETE PAVING
32 1723 - PAVEMENT MARKINGS
32 1823.53 - TENNIS COURT SURFACING
32 3113 - CHAIN LINK FENCES AND GATES
32 3900 - MISCELLANEOUS SITE SPECIALTIES
32 9200 - TURF AND GRASSES
32 9300 - PLANTS

DIVISION 33 — UTILITIES

33 0100 - EXCAVATING
33 2150 - FACILITY WATER
33 4100 - STORM UTILITY DRAINAGE PIPING
33 4600 - SUBDRAINAGE

DOCUMENT 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 2500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
 - 1. Extensive revisions to the Contract Documents are not required.
 - 2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
 - 3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:
 - 1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
 - 2. Submittal Format: Submit three copies or email PDF copy of each written Procurement Substitution Request, using form bound in Project Manual.
 - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
 - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

- 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
 - 2) Copies of current, independent third-party test data of salient product or system characteristics.
 - 3) Samples where applicable or when requested by Architect.
 - 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
 - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
- c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
- d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.
- B. Architect's Action:
1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.
- C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 00 2600

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

1.1 EXISTING REPORTS AND SURVEYS

A. SUBSURFACE INVESTIGATION REPORT

B. A copy of a geotechnical report with respect to the building site is available for viewing:

1. Title: Geotechnical Report, Hemlock Public Schools.
2. Date: September 28, 2022.
3. Prepared by: Spicer Group.

C. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the Architect.

D. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

E. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to the Owner.

F. The soil boring logs from this report are included with this document.

1.2 TOPOGRAPHIC SURVEY

A. A copy of a topographic survey with respect to the project site is available for viewing:

1. Title: Boundary, Topographic & Utility Survey for Hemlock Public Schools.
2. Date: September 23, 2022.
3. Prepared by: Spicer Group.

B. This survey identifies grade elevations prepared primarily for the use of the Architect in establishing new grades and identifying natural water shed.

1.3 EXISTING CONDITIONS SURVEY

A. A copy of a survey with respect to the condition of the existing construction is available for viewing:

1. Title: Three Year Asbestos Reinspection.
2. Date: July 12, 2022.
3. Prepared by: Fortress Environmental Solutions, LLC.

B. This survey identifies conditions of existing construction prepared primarily for the use of the owner for on-going operations.

END OF DOCUMENT 00 3100

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SECTION 00 4325 - SUBSTITUTION DURING PROCUREMENT REQUEST FORM

1.1 INTRODUCTORY INFORMATION

- A. Date: _____
- B. Requesting substitution of _____
- C. As specified in Section _____
- D. Requested Substitute Product: _____

1.2 SUBMITTING PARTY'S STATEMENT

- A. Circle "Y" for yes and "N" for no for each of the following statements and submit supporting data. Indicate impact for all statements below answered as no, with supporting data:
 - 1. [Y] [N] Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. [Y] [N] Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. [Y] [N] Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. [Y] [N] Substitution request is fully documented and properly submitted in accordance with "Product Substitution" and "Submittals" Articles in Division 01 Section "Product Requirements."
 - 5. [Y] [N] Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. [Y] [N] Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. [Y] [N] Requested substitution is compatible with other portions of the Work.
 - 8. [Y] [N] Requested substitution has been coordinated with other portions of the Work.
 - 9. [Y] [N] Requested substitution provides specified warranty.
- B. I hereby certify that the above statements are true.
- C. _____
- D. Submitter's signature

END OF DOCUMENT 00 4325

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SECTION 00 6323 - CADD FILE TRANSFER WAIVER

- A. At your request, TowerPinkster will provide CADD files to your organization for your convenience and use in the preparation of shop drawings related to the above project, subject to the following terms and conditions:
1. Our electronic files are compatible with AutoCAD 2016 and newer software. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.
 2. Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to TowerPinkster. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or subsconsultants that may arise out of or in connection with your use of the electronic files.
 3. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.
 4. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the hard-copy construction documents prepared by us and the electronic files, the hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.
 5. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.
- B. We will furnish you with electronic files of the following drawing sheets: _____
- C. Architect's copyright protected CAD drawings are available strictly for the use of preparing shop drawings. Architect will email files upon receipt this form, fully executed.
- D. Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either express or implied, or merchantability and fitness for any particular purpose. In no event shall we be liable for any loss or profit or any consequential damages as a result of your use or reuse of these electronic files.

1.2 REQUESTER'S STATEMENT

- A. I have reviewed the terms of this request and am in agreement with the conditions stated.

Requester's signature

END OF DOCUMENT 00 6325

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SECTION 00 6324 - BIM TRANSFER WAIVER

INTENT

- A. This document amends and supplements the Digital Data Licensing Agreement AIA C106 - 2013 for requests for BIM Model from the Architect. All provisions which are not so amended or supplemented remain in full force and effect.
- B. At the request of the Contractor, subcontractor, lower-tier subcontractor, or material supplier, and receipt of signed copy of Digital Data Licensing Agreement AIA C106, the Architect will transmit or send BIM model(s) requested.
- C. MODIFICATIONS TO AIA C106
- D. ARTICLE 3 – LICENSE CONDITIONS
- E. Add the following clauses after the first sentence in Article 3:
 - 1. We make no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.
 - 2. Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience in the support of construction coordination for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Tower Pinkster Titus Associates. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against us, our officers, directors, employees, agents or subconsultants that may arise out of or in connection with your use of the electronic files.
 - 3. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.
 - 4. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the hard-copy construction documents prepared by us and the electronic files, the hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.
 - 5. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display.

END OF DOCUMENT 00 6324

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SECTION 00 6325 - SUBSTITUTION DURING CONSTRUCTION REQUEST FORM

1.1 INTRODUCTORY INFORMATION

- A. Date: _____
- B. Requesting substitution of _____
- C. As specified in Section _____
- D. Requested Substitute Product: _____

1.2 SUBMITTING PARTY'S STATEMENT

- A. Circle "Y" for yes and "N" for no for each of the following statements and submit supporting data. Indicate impact for all statements below answered as no, with supporting data:
 - 1. [Y] [N] Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. [Y] [N] Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. [Y] [N] Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. [Y] [N] Substitution request is fully documented and properly submitted in accordance with "Product Substitution" and "Submittals" Articles in Division 01 Section "Product Requirements."
 - 5. [Y] [N] Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. [Y] [N] Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. [Y] [N] Requested substitution is compatible with other portions of the Work.
 - 8. [Y] [N] Requested substitution has been coordinated with other portions of the Work.
 - 9. [Y] [N] Requested substitution provides specified warranty.
- B. I hereby certify that the above statements are true.

Submitter's signature

1.3 CONTRACTOR'S STATEMENT

- A. I have reviewed this substitution request and am in agreement with the information presented and statements made. This proposal is complete, and there will be no further charges to the Owner as a result of the acceptance of this substitution.

Contractor's signature

END OF DOCUMENT 00 6325

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SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Hemlock Elementary Café Canopy.
 - 1. Base Bid: Cafe Canopy indicated as Alternate No. 1 is not a part of base bid.
 - 2. Alternate: If Alternate No. 1 is accepted, provide Café Canopy indicated as Alternate No. 1.
- B. Alternate No. 2: Hemlock Elementary Multi-purpose room acoustic treatment.

1. Base Bid: Multi-purpose room acoustical treatment indicated as Alternate No. 2 is not part of base bid.
 2. Alternate: If Alternate No. 2 is accepted, the removal and salvage of existing tectum wall panel in the Multi-purpose room shall be performed. Reinstallation of salvaged material is not to be included in the alternate as reinstallation will be performed by owner. Included with the alternate shall be the providing (furnish and install) of new acoustic wall panels listed on the drawings as "AWP-1,2,3".
- C. Alternate No. 3: KC Ling Softball Field.
1. Base Bid: The only work to be completed as part of base bid is minor regrading and seeding around the road. The new softball field indicated as Alternate No. 3 is not part of base bid.
 2. Alternate: If Alternate No. 3 is accepted, provide the new softball field and related as shown outlined on the drawings.
- D. Alternate No. 4: KC Ling Sinks.
1. Base Bid: Sink removal and casework indicated as Alternate No. 4 is not part of base bid.
 2. Alternate: If Alternate No. 4 is accepted, the removal of three (3) existing sinks and related casework shall be performed including capping of lines and patching of walls as required. Also inclusive of Alternate No. 4 is to provide new wardrobe casework (at three locations) as indicated on the drawings.

END OF SECTION 01 2300

SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 31 1000 "Site Clearing" for removing existing trees and shrubs.
 - 3. Section 32 9300 "Plants" for replacing damaged trees within protection zones.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches (2400 mm) unless otherwise indicated.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.
 - c. Quality-control program.
 - d. Coordination of Work and equipment movement with the locations of protection zones.
 - e. Trenching by hand or with air spade within protection zones.
 - f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 2. Detail fabrication and assembly of protection-zone fencing and signage.
 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
 1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 2. Protection-Zone Fencing: None required.
 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 1. Species and size of tree.
 2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Must have at least three of the following

1. Certified Arborist as certified by ISA.
2. Certified Arborist-Municipal Specialist as certified by ISA.
3. Licensed arborist in jurisdiction where Project is located.
4. Current member of ASCA Registered Consulting Arborist as designated by ASCA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Tree Protection Warranty:

1. Conditions. If, within a period of two years after date of substantial completion, any tree or trees in protection areas die or suffer significant loss due to damage caused by improper tree protection to the protection zone, or the tree itself, then the Contractor shall pay for all costs associated with fully removing and replacing the tree.

- a. Removal will include (but not be limited to) trimming, cutting, hauling away, stump grinding, excavation, backfill, replacement, staking, guying, and inclusion of full new tree warranty according to Section 32 9300 "Plants".
2. Replacements:
 - a. See FIELD QUALITY AND CONTROL section near the end of this specification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
 2. Planting Soil: Planting soil as specified in Section 32 9300 "Plants".
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 1. Type: Shredded hardwood.
 2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
 1. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch (50-by-100-mm) horizontal rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 96 inches (2400 mm) apart, and lower rail set halfway between top rail and ground.
 - a. Height: 48 inches (1200 mm).
 - b. Lumber: Comply with requirements in Section 06 1000 "Rough Carpentry." Previously used materials may be used when approved by Architect.
 2. Gates: Single- or Double- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm).
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 1. Size and Text: As shown on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 2-inch (50-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 2. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet (10.5 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Cut Ends: Do not paint cut root ends.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 31 2000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
 - 1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning, raising, reducing, and thinning where indicated.
 - b. Specialty Pruning: Structural restoration vista and utility where indicated.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and spread over areas identified by Architect or stockpile in areas approved by Architect, unless the branches are diseased or otherwise could cause deleterious effects to any impacted portion of the project as identified by Arborist.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide one new tree of 4-inch to 6-inch caliper size for each tree that measures 12 inches (300 mm) or smaller in caliper size.
 - 2. Large Trees: Provide one new tree of 8-inch to 10-inch caliper size for each tree being replaced that measures more than 12 inches (300 mm) in caliper size.
 - a. Species: As selected by Architect.
 - 3. Plant and maintain new trees as specified in Section 32 9300 "Plants."

- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch (50-mm) uniform thickness to remain.

- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 5639

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."
- F. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 - 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.
 - 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 - 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

7. Protect stored products from damage and liquids from freezing.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
 7. All products shall be free from asbestos.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."
 1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**PRODUCT REQUIREMENTS
01 6000 - 6
12/21/2022**

- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 7300 "Execution" for cutting and patching procedures.
2. Section 31 1000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.

- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- D. Predemolition photographs or video.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video, and templates as appropriate.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- E. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
4. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Maintain fire watch during flame-cutting operations.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 5323 for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.7 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 4119

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.

1.3 INFORMATIONAL SUBMITTALS

- A. Material test reports.
- B. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301 (ACI 301M).
 2. ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Materials:
1. Portland Cement: ASTM C 150/C 150M, Type I or Type I/II, gray.
 2. Fly Ash: ASTM C 618, Class F or C.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - 3.
 4. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50(0.3 mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50(0.3 mm).
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

- E. Water: ASTM C 94/C 94M and potable.

2.4 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum water-vapor permeance of 0.02 U.S. perms, minimum 15 mils(0.38 mm) thick monolithic polyolefin sheet. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.
 - b. Insulation Solutions, Inc.; Viper VaporCheck II 15-mil.
 - c. Poly-America, L.P.; Husky Yellow Guard Vapor Barrier 15 Mil ASTM E-1745 Class A.
 - d. Reef Industries, Inc; Griffolyn 15 mil Green.
 - e. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc; A-H Curing Compound #2 DR WB.
 - 2. ChemMasters, Inc; Safe-Cure Clear DR.
 - 3. Dayton Superior; Clear Resin Cure J11W.
 - 4. Euclid Chemical Company (The); an RPM company; Kurez DR VOX.
 - a. Kaufman Products, Inc; Thinfilm 420.
 - 5. L&M Construction Chemicals, Inc; L&M CURE R.
 - a. Lambert Corporation; AQUA KURE - CLEAR.
 - b. Nox-Crete Products Group; Resin Cure E.
 - c. Right Pointe; Clear Water Resin.
 - d. SpecChem; PaveCure Rez.
 - e. TK Products; TK-2519 DC WB.
 - f. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.
 - g. W.R. Meadows, Inc; 1100-CLEAR SERIES.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. 20 percent fly ash or 30 percent ground blast furnace slag.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
 - 4. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- B. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.2 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.5 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view,.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings.

- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.

- b. Perform additional tests when concrete consistency appears to change.
3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

- 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 48 hours of completion of floor finishing and promptly report test results to Architect.

END OF SECTION 03 3000

SECTION 03 5416 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

PART 2 - PRODUCTS

2.1 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch (6 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ARDEX Americas; K-15 Self-Leveling Underlayment Concrete.
 - b. Bonsal American, an Oldcastle company; ProSpec Level Set 200.

- c. Laticrete International, Inc.; Levelex.
 - d. MAPEI Corporation; Ultraplan 1 Plus.
 - e. Maxxon Corporation; Level-Right.
2. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
 3. Compressive Strength: Not less than 4000 psi (27.6 MPa) at 28 days when tested according to ASTM C109/C109M.
 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- E. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare and clean substrate according to manufacturer's written instructions.
1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.
- C. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

- D. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.2 INSTALLATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
 - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Install underlayment to produce uniform, level surface.
 - 1. Install a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

END OF SECTION 03 5416

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SECTION 03 6000 - POST INSTALLED ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes post installed concrete anchors requirements for the following:
 - 1. Mechanical Anchors.
 - 2. Adhesive Anchors.
- B. Related Sections:
 - 1. Division 03 Section "Cast-In-Place Concrete".
 - 2. Division 04 Section "Unit Masonry".
 - 3. Division 05 Section "Structural Steel Framing".

1.2 DEFINITION

- A. Post Installed Anchors: Anchors installed into hardened concrete or fully constructed hollow or grouted masonry.

1.3 REFERENCE MATERIAL

- A. ACI 318 – Building Code Requirements for Structural Concrete
- B. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete
- C. ASTM A36 – Standard Specification for Carbon Structural Steel
- D. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- E. ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
- F. ASTM C881 – Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete
- G. ASTM E488 – Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
- H. ASTM E1512 – Standard Test Methods for Testing Bond Performance of Bonded Anchors
- I. ASTM F593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- J. ICC-ES AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
- K. ICC-ES AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
- L. ICC-ES AC60 – Acceptance Criteria for Anchors in Unreinforced Masonry Elements

- M. ICC-ES AC106 – Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Concrete or Masonry Elements
- N. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
- O. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

1.4 SUBMITTAL

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
 - 1. Product specifications with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.

1.5 Quality Assurance Submittals:

- a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- b. Certificates
 - 1) ICC ES Evaluation Reports
- B. Manufacturer's installation instructions.
- C. Installer Qualifications & Procedures: Submit installer qualifications to special inspector for approval prior to commencement of work.

1.6 QUALITY ASSURANCE

- A. Installer(s) Training:
 - 1. Product Manufacturer's certificate for each installer certifying they have been trained on the means and methods for installing the particular anchor.
- B. For horizontal and upwardly inclined adhesive installations, the installer shall be certified by an ACI/CRSI Adhesive Anchor Installing Certification Program or equivalent.
- C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications.
 - 1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to job site in manufacturer's or distributor's packaging undamaged, complete with installation instructions.
- B. General: Comply with Division 1 Section–Product Storage and Handling Requirements

1. Store anchors in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

1.8 MANUFACTURER

- A. All products are based on Hilti Corporation.
- B. Substitution:
 1. Upon approval by the engineer, the installer may substitute a product by a different manufacturer, provided that the manufacturer submits calculations signed and sealed by an engineer registered in the state of the project's location.
 - a. These calculations must show that the strength of the substituted anchor meets or exceeds the strength of the specified anchor at each application in the project where a substituted anchor is proposed, with consideration for combined stress and any applicable reduction factors.
- C. The substitution request and submittal shall be made a minimum of 2 weeks prior to planned installation of the anchors.
- D. The finish of the anchor shall remain the same as specified.

1.9 MECHANICAL ANCHORS

- A. Torque Controlled (TC) Anchors. Hilti Kwik Bolt TZ is a torque controlled expansion anchor suited to seismic and cracked concrete applications.
 1. Size: As indicated on drawings
 2. Finish: Plain carbon steel or stainless steel type 304 (316) as indicated on drawings.
- B. Screw Anchors: Hilti Kwik HUS-EZ anchors are comprised of a body with hex washer head.
 1. Size: As indicated on drawings
 2. Finish: As indicated on drawings
- C. Sleeve Anchors: Hilti HLC Sleeve Anchor are mechanical expansion anchors consisting of an externally threaded stud with an expanding sleeve for use in concrete and hollow and solid masonry base material.
 1. Size: As indicated on drawings
 2. Finish: As indicated on drawings

1.10 ADHESIVE ANCHORS

- A. In contract documents adhesive anchors may be generically referred to as epoxy anchors. Where this is the case the word adhesive should be substituted for epoxy.

- B. Adhesive anchors used in concrete under a tension condition cannot be installed until after the concrete has cured for a minimum 21 days in accordance with ACI 17.4.5.2.
- C. Concrete Anchor
1. Hilti HIT-RE 500-V3 is a high strength, two part epoxy adhesive.
 - a. Base material temperature range: 23 degrees up to 120 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1.25" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material: HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
 - e.
 2. Hilti HIT HY 200 is a two-component hybrid adhesive.
 - a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material: HY200 HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
 3. Hilti HIT HY 200 Safeset is a two-component hybrid adhesive.
 - a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material based on cleaning:
 - 1) No cleaning of hole:
 - a) HIT-Z, HIT-Z-R Threaded Rods
 - 2) Automatic cleaning of hole:
 - a) HY200 HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
- D. Masonry Anchor:
1. Hilti HIT HY-70 System is a hybrid adhesive consisting of a dual cylinder adhesive refill pack, a mixing nozzle, a screen tube, and either a threaded rod or rebar.
 - a. Size: As indicated on drawings
 - b. Finish: As indicated on drawings
 - c. Anchor Rod: HAS-E Standard ISO 898 Class 5.8.
 - d. Use: Hollow brick, hollow concrete masonry block, or grouted solid concrete masonry block.
 2. Hilti HIT HY 200 is a two-component hybrid adhesive.
 - a. Base material temperature range: 14 degrees up to 104 degrees Fahrenheit.
 - b. Size: As indicated on drawings, up to 1" diameter maximum.
 - c. Finish: As indicated on drawings
 - d. Anchor material: HY200 HAS Threaded Rod Standard ISO 898 Class 5.8, and Deformed Reinforcing Bars.
 - e. Use: Solid or grouted solid masonry only.

PART 3 - EXECUTION

1.11 POST INSTALLED ANCHORS

- A. All installation shall be done in accordance with manufacturer's ICC-ES report.
- B. Drilling:
 - 1. Drill holes with rotary impact hammer drills. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
 - 2. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
 - 3. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has met Manufacturer's specifications.
- C. Torque Controlled Anchors and Sleeve Anchors: Protect threads from damage during anchor installation. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.
- D. Screw Anchors: Install screw anchors to a snug tight condition unless noted otherwise.
- E. Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

1.12 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Continuous special Inspection of post-installed anchors shall be provided as required by ICC-ES evaluation reports. This service shall be performed by personnel independent of the Manufacturer or Contractor so as to prevent a conflict of interest.
- C. The Engineer or Architect of Record may require pullout or shear tests, in addition to Special Inspection, to determine the adequacy of anchors. A field testing program shall be established by the independent testing and inspecting agency and/or Engineer of Record and performed in accordance with appropriate ASTM test standards. Field tests shall be non-destructive whenever possible.

PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT

POST INSTALLED ANCHORS
03 6000 - 6
12/21/2022

END OF SECTION 03 6000

SECTION 04 2000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.

1.2 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.

7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

- A. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
 1. Density Classification: Normal weight for below-grade applications and for above-grade applications, unless indicated otherwise.
 2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

2.4 MORTAR AND GROUT MATERIALS

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Masonry Cement: ASTM C 91/C 91M.
- D. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 2. Pigments shall not exceed 5 percent of mortar cement by weight.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- F. Aggregate for Grout: ASTM C 404.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Exterior and Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Wire Size for Side and Cross Rods: 0.148-inch (3.77-mm) diameter.
 - 3. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: 16 inches (407 mm) o.c.
 - 5. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.6 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc.

2.7 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 1. For masonry below grade or in contact with earth, use Type S.
 2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1.
 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
- 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
- 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
- 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
- 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet ((6 mm in 3 m),) or 1/2-inch (12-mm) maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).

2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- A. Bond Pattern for Exposed Masonry: Do not use units with less than nominal 4-inch(100-mm) horizontal face dimensions at corners or jambs. Unless otherwise indicated, lay exposed masonry as follows:
 1. CMU: Running bond.
- B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. With webs fully bedded in mortar in all courses of fire rated walls, including contiguous piers, columns and pilasters.
5. With webs fully bedded in mortar in all courses of walls forming mechanical shafts, including but not necessarily limited to, plumbing shafts, supply and return air shafts not containing fabricated ducts.
6. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
7. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. Provide raked joints for application of sealant in joints in sills, coping, and similar items.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together as follows:

1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

B. Bond wythes of composite masonry together using bonding system indicated on Drawings.

C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry by fitting bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
- C. Form expansion joints in brick as follows:
 1. Build in compressible joint fillers where indicated.
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 9200 "Joint Sealants," but not less than 3/8 inch (10 mm).
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530/ASCE 6.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 2000

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SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Field-installed shear connectors.
3. Grout.

B. Related Requirements:

1. Section 05 1213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 05 3100 "Steel Decking" for field installation of shear connectors through deck.
3. Section 05 5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment Drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by a professional engineer responsible for their preparation and licensed to practice in the jurisdiction of the Project.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For fabricator.
 - B. Welding certificates.
 - C. Mill test reports for structural steel, including chemical and physical properties.
- 1.7 QUALITY ASSURANCE
- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
 - B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - C. Comply with applicable provisions of the following specifications and documents:
 1. AISC 303.
 2. AISC 360.
 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
 - B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Clean and relubricate bolts and nuts that become dry or rusty before use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360.
 - 2. Use Allowable Stress Design; data are given at service-load level.
- B. Construction: Combined system of moment frame and shear walls.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angle]-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Finish: Black except where indicated to be galvanized.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
 - 1. Finish: Mechanically deposited zinc coating.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

3. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.

E. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain, unless noted otherwise.

2.4 PRIMER

- A. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
- B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
 6. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 7. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless indicated as slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
 - 3. Galvanize structural steel that will be exposed to the exterior at project completion.

2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Do not use thermal cutting during erection.
- E. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened unless indicated as slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
 - 4. Perform special inspections in accordance with requirements of the "Michigan Building Code."
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

END OF SECTION 05 1200

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SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

B. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Research Reports: For steel deck, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer. Prime both sides of deck.
 2. Deck Profile: Type WR, wide rib.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Provide fasteners to supporting structure as specified on the drawings for individual decking types. Comply with the following:
 1. Powder-actuated carbon steel fasteners: Hilti X ENP 19 L 15 or Hilti X HSN24, or other pre-approved alternate.
- C. Side-Lap Fasteners: Provide sidelap fasteners as specified on the drawings based on individual decking types. Acceptable types of connectors:
 1. Hilti S-SLC 01 M HWH sidelap connector.
 2. No. 12 Self-drilling carbon steel screws.
 3. Other pre-approved alternate.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.2 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members as indicated on the drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on the drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.3 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

END OF SECTION 05 3100

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for mechanical and electrical equipment.
4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
5. Shelf angles
6. Metal ladders.
7. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 2000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 1200 "Structural Steel Framing."

1.2 COORDINATION

- A. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Ferrous Metals:
 - 1. W-Shapes: ASTM A992/A992M.
 - 2. Channels, Angles: ASTM A36/A36M.
 - 3. Plate and Bar: ASTM A36/A36M.
 - 4. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

C. Nonferrous Metals:

1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
2. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
3. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless-steel fasteners for fastening aluminum.
 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors complying with Section 03 6000 Post-Installed Anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

- F. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).
- G. Thermoplastic Sleeves: See Drawings for requirements.

2.5 FABRICATION

- A. General: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
 - 1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
 - 2. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 - 3. Form exposed work with accurate angles and surfaces and straight edges.
 - 4. Weld corners and seams continuously to comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended.
 - 5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
 - 6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 - 7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
 - 8. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 9. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.
- B. Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
 - 1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Shelf Angles: Fabricate shelf angles from steel angles of sizes indicated and for attachment to masonry framing.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
 - 3. Galvanize shelf angles located in exterior walls.
- D. Metal Ladders: Comply with ANSI A14.3, except for elevator pit ladders.

1. For elevator pit ladders, comply with ASME A17.1/CSA B44.
2. Steel Ladders:
 - a. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 - b. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
 - c. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
 - d. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - e. Galvanize exterior ladders, including brackets.
 - f. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.
 - g. Fabricate platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 3/4 inch (19 mm) in least dimension.
- E. Miscellaneous Steel Trim: Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
 1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 2. Galvanize exterior miscellaneous steel trim.
- F. Loose Bearing and Leveling Plates: Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 1. Finish: Leave unfinished.
- G. Loose Steel Lintels: Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
 1. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.
 2. Galvanize loose steel lintels located in exterior walls.
- H. Steel Weld Plates and Angles: Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.6 FINISHES

- A. General: Finish metal fabrications after assembly.
 1. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- B. Steel and Iron Finishes:
 1. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 2. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

- a. Shop prime with universal shop primer unless zinc-rich primer is indicated.
 3. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- C. Aluminum Finishes:
1. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
- D. Stainless Steel Finishes: Remove tool and die marks and stretch lines or blend into finish.
1. Bright, Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 2. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 3. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 4. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
 5. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 6. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - a. Cast Aluminum: Heavy coat of bituminous paint.
 - b. Extruded Aluminum: Two coats of clear lacquer.
- B. Installing Miscellaneous Framing and Supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

1. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.
 2. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - a. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
 3. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - a. Grout baseplates of columns supporting steel girders after girders are installed and leveled.
- C. Installing Bearing and Leveling Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
1. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 5000

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SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Handrail brackets.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

C. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 2-1/2-inch (64-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513/A513M, Type 5.

- B. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.
- D. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941 (ASTM F1941M), Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
- B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.

- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.

- F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #3 welds; utilitarian appearance not subject to view, partially dressed weld with spatter removed

- G. Form changes in direction as follows:
 - 1. As detailed.

- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

- I. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.

2.7 FINISHES

- A. Steel and Iron Finishes
 - 1. Galvanized Railings:
 - a. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - b. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - c. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - d. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - e. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

 - 2. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

 - 3. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner and as follows.
 - a. Comply with SSPC-SP 16.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.3 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.

3.4 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

END OF SECTION 05 5213

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SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs

inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Grounds.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 3 grade; SPIB.
 - 2. Eastern softwoods; No. 3 Common grade; NeLMA.
 - 3. Northern species; No. 3 Common grade; NLGA.
 - 4. Western woods; Standard or No. 3 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

- F. Roof-Edge Nailer: Engineered wood nailer with adhered insulation as follows:
1. Available Manufacturers: Available manufacturers include, but are not limited to, PreBuck Engineered Framing Systems.
 2. Engineered Nailer: LSL 1.30E Engineered Lumber, ICC ESR-1387, treated with zinc borate throughout complete cross section.
 - a. Nailer Thickness: 1-1/2 inches (38 mm), built-up as required.
 - b. Meets AWPA U1-15 for Use Category 2 (UC2).
 3. Insulation: Molded polystyrene board, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84, and preservative treated to resist termite degradation.
 - a. Type: Type XIV, 40-psi (276-kPa).
 - b. Insulation Thickness:.
 - c. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - d. Thermal Resistivity: 4.2 deg F x h x sq. ft./Btu x in. at 75 deg F (29.1 K x m/W at 24 deg C).

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC58 as appropriate for the substrate.
1. Material for Interior Applications: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 2. Material for Exterior Applications: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

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SECTION 06 4116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 12 3623.13 "Plastic-Laminate-Clad Countertops."

1.2 ALTERNATES

- A. The work of this Section is affected by alternates. Refer to Section 01 2300 "Alternates" for procedures for alternates.

- B. Alternate No. 4: KC Ling Sinks. (New wardrobe casework)

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Shop Drawings: For plastic-laminate-faced architectural cabinets.

1. Include plans, elevations, sections, and attachment details.

- C. Samples for Initial Selection: For each type of exposed finish that requires color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

- B. Research reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade VGS.
 - 3. Door and Drawer Edges: PVC edge banding, 0.12 inch (3 mm) thick.
 - 4. Other Edges: Grade VGS.
 - 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.

- a. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
 3. Drawer Bottoms: Thermally fused laminate panels.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. Plastic Laminate: As indicated by laminate manufacturer's designations on Drawings.
 2. PVC Edgebanding; As indicated by edgebanding manufacturer's designations on Drawings.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 2. Particleboard: ANSI A208.1, Grade M-3i.
 3. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction as determined by testing performed on identical products by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
 1. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.
- C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- F. Drawer Slides: ANSI/BHMA A156.9.
 1. Grade 1 and Grade 2: Side mount.
 - a. Type: Full extension.
 - b. Material: Zinc-plated steel with polymer rollers.
 2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated-steel, ball-bearing slides.
 3. Pencil drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
 4. General purpose drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
 5. File drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
 6. Lateral file drawers not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200.
 7. Computer keyboard tray, provide 75 lb (34 kg) load capacity.
- G. Door and Drawer Locks: Provide on all doors and drawers.
 1. Door Locks: BHMA A156.11, E07121.
 2. Drawer Locks: BHMA A156.11, E07041.
 3. Key all doors and drawers within a room alike and each room differently.
- H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
2. Satin Stainless Steel: ANSI/BHMA 630.

- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- B. Adhesive for Bonding Plastic Laminate: Contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with fasteners appropriate for substrate.

PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT

PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS
06 4116 - 6
12/21/2022

END OF SECTION 06 4116

SECTION 06 6400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Plastic sheet paneling.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories.

1.3 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Crane Composites, Inc.
 - b. Glasteel.
 - c. Nudo Products, Inc.
 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 200 or less.
 - b. Smoke-Developed Index: 450 or less.
 3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
 4. Surface Finish: Molded pebble texture.
 5. Color: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.
- C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."
 - 1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- C. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

3.2 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 6400

SECTION 07 4293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded Aluminum soffit panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- B. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flat-Profile Extruded Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges.
 - 1. Basis of Design: Dizal Inc.; Profile Flat
 - a. Extruded Aluminum 6063-T5 alloy. Thickness: 0.062 inch (1.59 mm).
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Three-layer color and texture finish including
 - 1) Primer coat: for applied to aluminum for adhesion between ink and aluminum
 - 2) High-Definition digital inkjet printing to create photographic reproductions of colors and textures. Printing to be continuous to aluminum profile edge.
 - 3) UV Barrier: Protective Clear Coat for UV protection against fading. a. UV Fade Test: No change in 1000 hours when tested in accordance with ASTM G155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials, when tested by a 3rd Party Testing Agency.
 - d. Color: 110-01 White Ash – Medium Brown.
 - 2. Panel Coverage: 6 inches (152 mm).
 - 3. Panel Height: 0.50 inch (13 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.2 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Watertight Installation:
 - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - 3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 4293

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SECTION 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Roof insulation.
3. Cover board.
4. Walkways.

B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 3100 "Steel Decking."

C. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7100 "Roof Specialties" for roof edge flashings.
3. Section 07 7129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint assemblies.
4. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Section 22 1423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness if insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Evaluation Reports: For components of roofing system, from ICC-ES.
- D. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality-control reports.
- F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing membrane, all other items specified in this Section, flashings and counterflashings, coping and gravel stop, and other components of membrane roofing system.
 - 2. Wind Speed: Warranty shall not have limitation for wind damage for wind speed less than 70 mph(113 kph).
 - 3. Warranty Period: 15 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D 3746, ASTM D 4272, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): 25.6 lbf/sq. ft. (1.22 kPa/sq. m).
 - 2. Zone 2 (Roof Area Perimeter): 42.9 lbf/sq. ft. (2.05 kPa/sq. m).
 - a. Location: From roof edge to 20 feet (6.1 m) inside roof edge.
 - 3. Zone 3 (Roof Area Corners): 64.6 lbf/sq. ft. (3.08 kPa/sq. m).
 - a. Location: 20 feet (6.1 m) in each direction from building corner.
- D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
 - 1. Wind Uplift Load Capacity: 75 psf.
- E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D 4637/D 4637M, [Type I, nonreinforced,] [Type II, scrim or fabric internally reinforced,] EPDM sheet[with factory-applied seam tape].
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GenFlex Roofing Systems.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Versico Incorporated.
 - 2. Thickness: 60 mils (1.5 mm), nominal.
 - 3. Exposed Face Color: Black.
 - 4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Bonding Adhesive: Manufacturer's standard.
- E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film.
- F. Lap Sealant: Manufacturer's standard, single-component sealant.
- G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Compressive Strength: 20 psi (138 kPa).
 - 2. Thickness:
 - a. Base Layer: 2-1/2 inches (64 mm).
 - b. Upper Layer: 2-1/2 inches (64 mm).
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch (6.35 mm).
 - 3. Slope: As required to provide minimum roof slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

2.5 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- C. Cover Board: ASTM C 1289 Type II, Class 4, Grade 1, 1/2-inch- (13-mm-) thick polyisocyanurate, with a minimum compressive strength of 80 psi (551 kPa).
1. Thermal Resistance: Minimum R 2.5.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.
1. Size: Approximately 36 by 60 inches (914 by 1524 mm).
 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3100 "Steel Decking."

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:

- 1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).

- f. Trim insulation so that water flow is unrestricted.
- g. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
- h. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- i. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.

3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 ADHERED ROOFING INSTALLATION

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions and NRCA recommended details.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide 6-inch (76-mm) clearance between adjoining pads.
 - 3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5323

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed wall sheet metal fabrications.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7100 "Roof Specialties" for roof specialties associated with low-slope roofs.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 07 9500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

- B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. Color: As selected by Architect from manufacturer's full range.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: 4 (polished directional satin).

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 1. Obtain field measurements for accurate fit before shop fabrication.
 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 WALL SHEET METAL FABRICATIONS

- A. Fascia Flashing: Fabricate from the following materials:
 - 1. Aluminum: 0.050 inch (1.27 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.
- B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
 - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact

surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 6200

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-edge specialties.
2. Reglets and counterflashings.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 7129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
3. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
4. Section 07 9200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing."

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.6 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing.
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. SPRI Wind Design Standard: Manufacture and install roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Horizontal Outward at Perimeter: 58 psf (2.8 KPa).
 - 2. Horizontal Outward at Corner: 73 psf (3.5 KPa).
 - 3. Vertical Upward at Perimeter: 101 psf (4.8 KPa).
 - 4. Vertical Upward at Corner: 152 psf (7.3 KPa).
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed galvanized-steel sheet cant, 0.028 inch (0.71 mm) thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Architectural Products Company.
 - b. ATAS International, Inc.
 - c. Castle Metal Products.
 - d. Cheney Flashing Company.
 - e. Drexel Metals.
 - f. Exceptional Metals.
 - 1) Hickman Company, W. P.
 - g. Merchant & Evans Inc.
 - h. Metal-Era, Inc.
 - i. OMG Roofing Products.
 - j. Petersen Aluminum Corporation.
 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch (1.27 mm) thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer .
 - c. Color: Dark bronze.
 3. Corners: Factory mitered and continuously welded.
 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.3 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cheney Flashing Company.
 2. Fry Reglet Corporation.
 3. Hickman Company, W. P.
 4. Metal-Era, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
 2. Corners: Factory mitered and continuously welded.
 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
 - 1. At Reglets: Zinc-coated steel, nominal 0.028-inch (0.71-mm) thickness.
 - 2. At Through-Wall Flashing: Stainless steel, 0.025 inch (0.64 mm) thick.
- D. Accessories:
 - 1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 - 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
 - 1. Color: As selected by Architect from manufacturer's full range.
- F. Stainless Steel Finish: ASTM A480/A480M No. 2B (bright, cold rolled, unpolished).

2.4 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.5 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970/D 1970M; stable after testing at 240 deg F (116 deg C).
 - 2. Low-Temperature Flexibility: ASTM D 1970/D 1970M; passes after testing at minus 20 deg F (29 deg C).
- B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
- B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.7 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Coil-Coated Galvanized-Steel Sheet Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- C. Coil-Coated Aluminum Sheet Finishes:
1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
1. Apply continuously under roof-edge specialties and reglets and counterflashings.
 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
- B. Slip Sheet: Install over underlayment with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.3 ROOF-EDGE SPECIALITIES INSTALLATION

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.4 REGLET AND COUNTERFLASHING INSTALLATION

- A. Embedded Reglets: See Section 04 2000 "Unit Masonry" for installation of reglets.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 07 7100

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SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Penetration firestopping systems for the following applications:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to

install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.
- C. Do not cover up penetration firestopping installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."
 - 3) FM Approval in its "Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems

shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

- C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- D. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

3.3 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 8413

SECTION 07 8443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints in smoke barriers.

B. Related Requirements:

1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
2. Section 07 9500 "Expansion Control" for fire-resistive architectural joint systems.
3. Section 09 2216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until building inspector of authorities having jurisdiction have examined each installation.
- C. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek Group in its "Directory of Listed Building Products."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- D. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content:

1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- F. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.3 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN.
- B. Head-of-Wall, Fire-Resistive Joint Firestopping Systems : At the top of each fire-rated concrete or masonry wall, provide the following:
 - 1. UL-Classified Systems: HW-S-0021, HW-S-0024, HW-S-0025, HS-S-0027, or HW-S-0029.
 - 2. Nominal Joint Width: 1 inch(25 mm).
 - 3. Movement Capabilities: Class II - percent compression or extension.
- C. Head-of-Wall, Fire-Resistive Joint Firestopping Systems : At the top of each fire-rated gypsum board wall, provide the following:
 - 1. UL-Classified Systems: HW-D-0032, HW-D-0033, or HW-D-0042.
 - 2. Nominal Joint Width: 1 inch(25 mm).
 - 3. Movement Capabilities: Class II - percent compression or extension.

END OF SECTION 07 8443

SECTION 07 9200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

B. Related Requirements:

1. Section 07 9219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
2. Section 32 1373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range unless indicated otherwise.
 - 1. Provide custom colors to match Architect's samples for silicone sealant with less than 20 color selections available.
 - 2. Provide multiple sealant colors for each material that the sealant is adjacent to.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS.
 - b. Sika Corporation; Sikasil WS-295 FPS.
 - c. Tremco Incorporated; Spectrem 3.
- C. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:

- a. Tremco Incorporated; Spectrem 4-TS.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 2000.
 - b. Pecora Corporation; Dynatrol I-XL.
 - c. Polymeric Systems, Inc; Flexiprene 1000.
 - d. Sherwin-Williams Company (The); Stampede-1.
 - e. Tremco Incorporated; Dymonic.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Polymeric Systems, Inc; Flexiprene 952.
 - b. Sherwin-Williams Company (The); Stampede 1SL.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT, White: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786-M White.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - c. Tremco Incorporated; Tremsil 200.
- C. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT, Clear: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 999-A.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - c. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 300.
 - b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Construction Systems; MasterSeal NP 520.
 - b. Pecora Corporation; AC-20.
 - c. Sherwin-Williams Company (The); 950A Siliconized Acrylic Latex Caulk.
 - d. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#1.

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Control and expansion joints in unit masonry.
- c. Joints in exterior insulation and finish systems.
- d. Joints between dissimilar materials.
- e. Perimeter joints between exterior wall construction and frames of storefront framing, doors, windows, and louvers.
- f. Control and expansion joints in ceilings and other overhead surfaces.
- g. Other joints as indicated on Drawings.

2. Joint Sealant: One of the following:

- a. Silicone, nonstaining, S, NS, 50, NT.
- b. Silicone, nonstaining, M, NS, 50, NT.

- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#2.

1. Joint Locations:

- a. Perimeter joints of exterior openings.

2. Joint Sealant: One of the following:

- a. Silicone, nonstaining, S, NS, 50, NT.
- b. Silicone, nonstaining, M, NS, 50, NT.

- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#3.

1. Joint Locations:

- a. Isolation joints in exposed cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, P, 25, T, NT.

- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#4.

1. Joint Locations:

- a. Tile control and expansion joints.

2. Joint Sealant: Urethane, S, NS, 25, NT.

- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement JS-#5.
 - 1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.

- F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#6.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT, white.
 - 3. Joint-Sealant Color: White.

- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#7.
 - 1. Joint Locations:
 - a. Joints between countertops and backsplashes.
 - 2. Joint Sealant: Silicone, mildew resistant, acid curing, clear, S, NS, 25, NT.
 - 3. Joint-Sealant Color: Clear.

- H. Joint-Sealant Application: Concealed mastics JS-#8.
 - 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - 2. Joint Sealant: Butyl-rubber based.

END OF SECTION 07 9200

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SECTION 07 9219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 07 9200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
- B. VOC Content of Interior Sealants: Sealants and sealant primers shall comply with the following:
 - 1. Acoustical sealants and sealant primers shall have a VOC content of 250 g/L or less.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; RCS20 Acoustical.
 - b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
 - c. Pecora Corporation; AC-20 FTR.

- d. Tremco Incorporated; Acoustical Sealant 30CTG.
 - e. United State Gypsum Company; Sheetrock Acoustical Sealant.
- B. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- C. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

END OF SECTION 07 9219

SECTION 08 3323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service doors.

B. Related Requirements:

1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
2. Show locations of controls, locking devices detectors or replaceable fusible links, and other accessories.
3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Cookson Company.
- 2. Cornell Iron Works, Inc.
- 3. Overhead Door Corporation.
- 4. Raynor.

- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

- 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

- 1. Operation Cycles: Door components and operators capable of operating for not less than 20,000.
- 2. Door Curtain Material: Galvanized steel.
- 3. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.
- 4. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished to match door.
- 5. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- 6. Hood: Match curtain material and finish.

- a. Mounting: As indicated on Drawings.

- 7. Manual Door Operator: Push-up operation.
- 8. Curtain Accessories: Equip door with astragal.
- 9. Door Finish:

- a. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.3 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.

- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.6 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- C. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- D. Poll Hooks: Provide pole hooks and poles for doors more than 84 inches (2130 mm) high.

2.7 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

- A. Push-up Door Operation: Lift handles for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).
- B. Locking mechanism: Mortise cylinder for doors A119A and A119B. Verify cylinder compatibility with door manufacturer prior to order.
 - 1. Mortise cylinder to be keyed to existing. Coordinate with owner.
 - 2. Finish: 626
 - 3. Manufacturer: C-R

2.9 FINISH REQUIREMENTS

- A. General: Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
 - 1. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Steel and Galvanized-Steel Finishes:
 - 1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - a. Where powder-coat finish is indicated as selected from manufacturer's full range, provide minimum of 50 color selections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

3.2 STARTUP SERVICE

- A. Startup Service: Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

- B. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Lubricate bearings and sliding parts as recommended by manufacturer.
 - 2. Adjust seals to provide tight fit around entire perimeter.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 3323

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SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

B. Related Requirements:

1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation reports for firestop tracks.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C 645.
1. Steel Studs and Tracks:
 - a. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
 - b. Depth: 3-5/8 inches (92 mm) unless indicated otherwise.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Track System: ASTM C 645 top track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
 2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
 - 2) CEMCO; California Expanded Metal Products Co.; CST Slotted Deflection Track.
 - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 4) Metal-Lite; The System.
 - 5) Steel Network, Inc. (The); VertiTrack VT.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BlazeFrame Industries; Intumescent Framing, Fire Stop System.
 - b. CEMCO; California Expanded Metal Products Co.; FAS Track.
 - c. ClarkDietrich Building Systems; BlazeFrame.
 - d. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - e. Metal-Lite; The System.
 - f. Perfect Wall, Inc.; The System Slotted Deflection Track.
 - g. Steel Network, Inc. (The); VertiTrack VT.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
 2. Depth: 1-1/2 inches (38 mm) unless otherwise indicated

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Depth: 1-1/2 inches (38 mm).
- E. Furring Channels (Furring Members):
 - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
 - a. Minimum Base-Metal Thickness: 0.0179 inch (0.455 mm).
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension.
 - c. United State Gypsum Company; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754 and AISI S200.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
 - 1. Install bracing on uncovered side of studs at walls covered on one side only at 48 inches (1.2 m) on center maximum.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Spacing: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

- b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:
 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches (1219 mm) o.c.
 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
 3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 07 9219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CertainTeed Corporation.
 - 2. Continental Building Products, LLC.
 - 3. Georgia-Pacific Building Products.
 - 4. National Gypsum Company.
 - 5. USG.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch (6.4 mm).
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 1/2 inch (12.7 mm).
 - 2. Long Edges: Tapered.
- E. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
 - 1. Products:
 - a. Certainteed Corporation; Extreme Impact with M2 Technology.
 - b. Continental Building Products, LLC; Protecta HIR 300.

- c. National Gypsum Company; Hi-Impact XP Wallboard.

- d. USG Corporation; Mold Tough VHI Abuse-Resistant Panels.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
7. Long Edges: Tapered.
8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc Tile Backer.
 - b. Georgia-Pacific Building Products; DensShield Tile Backer.
 - c. National Gypsum Company; eXP Tile Backer.
 - d. Temple-Inland Building Products by Georgia-Pacific; Green Glass Tilebacker.
 - e. USG; Durock Brand Glass-Mat Tile Backerboard.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (control) joint.
 - d. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Board: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

- D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Laminating adhesive shall have a VOC content of 50 g/L or less).

- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Thickness: 3-1/2 inches(89 mm) unless indicated otherwise.

- E. Acoustical Sealant: As specified in Section 07 9219 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 APPLYING PANELS

- A. General: Comply with ASTM C 840.
 - 1. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
 - 2. Form control and expansion joints with space between edges of adjoining gypsum panels.
 - 3. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

- a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - b. Fit gypsum panels around ducts, pipes, and conduits.
 - c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
4. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
 5. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 6. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
 7. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
 8. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
- B. Install interior gypsum board in the following locations:
1. Type X: Vertical surfaces unless otherwise indicated.
 2. Flexible Type: Apply in double layer at curved assemblies.
 3. Ceiling Type: Ceiling surfaces.
 4. Impact-Resistant Type: As indicated on Drawings.
 5. Tile Backing Panels: Locations to receive tile.
- C. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- D. Multilayer Application:
1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- E. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- F. Curved Surfaces:
 - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
 - 2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.
- G. Applying Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 - 2. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- H. Installing Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
 - 1. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
 - 2. Interior Trim: Install in the following locations:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: Use at exposed panel edges.
 - c. Curved-Edge Cornerbead: Use at curved openings.

3.2 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for sound or fire rated assemblies.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

4. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 2900

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SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Research reports.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient

temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Class A according to ASTM E 1264.

2.2 ACOUSTICAL PANELS

- A. Acoustic Panel Ceiling (ACP-1): Provide manufacturer's standard panels complying with Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.
1. Product: Subject to compliance with requirements, provide the following:
 - a. Armstrong Ceiling and Wall Solutions: Ultima.
 2. Color: White .
 3. Light Reflectance (LR): Not less than 0.90.
 4. Ceiling Attenuation Class (CAC): Not less than 35 .
 5. Noise Reduction Coefficient (NRC): Not less than 0.75 .
 6. Edge/Joint Detail: Square .
 7. Thickness: 3/4 inch (19 mm) .
 8. Modular Size: 24 by 24 inches (610 by 610 mm).
 9. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
 10. Grid Type: 1.
- B. Acoustic Panel Ceiling (ACP-2): Provide manufacturer's standard panels complying with Type and Form: Type IX, mineral base with membrane-faced overlay; Form 2, with washable vinyl-film overlay according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.
1. Product: Subject to compliance with requirements, provide the following:
 - a. Armstrong Ceiling and Wall Solutions: Kitchen Zone.
 2. Color: White.
 3. Light Reflectance (LR): Not less than 0.89.
 4. Ceiling Attenuation Class (CAC): Not less than 33.
 5. Edge/Joint Detail: Square.
 6. Thickness: 5/8 inch (15 mm).

7. Modular Size: 24 by 24 inches (610 by 610 mm).
 8. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
 9. Grid Type: 1.
- C. Acoustic Panel Ceiling (ACP-3): Provide manufacturer's standard panels complying with Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face according to ASTM E 1264 and, pattern, acoustical rating, and light reflectance unless otherwise indicated.
1. Product: Subject to compliance with requirements, provide the following:
 - a. Armstrong Ceiling and Wall Solutions: Ultima.
 2. Color: White.
 3. Light Reflectance (LR): Not less than 0.90.
 4. Ceiling Attenuation Class (CAC): Not less than 35.
 5. Noise Reduction Coefficient (NRC): Not less than 0.75.
 6. Edge/Joint Detail: Square.
 7. Thickness: 3/4 inch (19 mm).
 8. Modular Size: 24 by 48 inches (610 by 1220 mm).
 9. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
 10. Grid Type: 1.

2.3 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- B. Wide-Face, Capped, Double-Web, Steel Suspension System (Type-1): Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong Ceiling and Wall Solutions; Prelude ML 15/16 inch Exposed Tee System.
 - b. CertainTeed Corp.; 15/16 inch Classic Hook System.
 - c. Rockfon (Roxul Inc.); Snap Grid 200.
 - d. USG Interiors, Inc.; Subsidiary of USG Corporation; Donn DX.
 2. Structural Classification: Intermediate-duty system.

3. End Condition of Cross Runners: Butt-edge type.
4. Face Design: Flat, flush.
5. Cap Material: Cold-rolled steel.
6. Cap Finish: Painted to match color of acoustical unit.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Hold-Down Clips: Manufacturer's standard hold-down.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
 3. Provide trim cover pieces fabricated for inside and outside corners appropriate for adjacent construction.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong Ceiling and Wall Solutions; Axiom Classic.
 - b. CertainTeed Corp.; Terminus Straight Trim.
 - c. Rockfon (Roxul Inc.); Infinity Engineered.
 - d. USG Interiors, Inc.; Compasso Elite.
 2. Profile Depth: 4 inches (**102** mm) unless indicated otherwise.

3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels with pattern running in one direction parallel to long axis of space.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. Install hold-down clips within 20 ft (6.1 m) of exterior doors and in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

END OF SECTION 09 5113

SECTION 09 6500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient sheet flooring.
2. Resilient tile flooring.

B. Related Sections:

1. Section 09 6513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.
2. Section 09 6566 "Resilient Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: For each type of resilient flooring, in manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.
 - 2. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).
 - 1. Store rolls upright.
 - 2. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient flooring during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during resilient flooring installation.
- D. Close spaces to traffic for 48 hours after resilient flooring installation.
- E. Install resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RESILIENT FLOORING

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 RESILIENT SHEET FLOORING

- A. Sheet Vinyl Flooring (SV-1): As follows:
 - 1. Product: As indicated on Material Selection Schedule.

2.4 RESILIENT TILE

- A. Luxury Vinyl Floor Tile (LVT-1): As follows:
 - 1. Product: As indicated on Material Selection Schedule.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Trowel-Applied Underlayment: Portland cement-based matrix formulated for skim-coating flooring substrates.
 - 1. Product: Ardex; Feather Finish.
- C. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
- D. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Colors: Match flooring.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

E. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to resilient flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient flooring manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Existing Buildings: Provide trowel-applied underlayment over all surfaces to receive resilient flooring where existing flooring is removed.
- E. Do not install resilient flooring until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient flooring.

3.2 RESILIENT FLOORING INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing resilient flooring.

1. Scribe and cut resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
 2. Extend resilient flooring into toe spaces, door reveals, closets, and similar openings.
 3. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient flooring as marked on substrates. Use chalk or other nonpermanent marking device.
 4. Install resilient flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
 5. Adhere resilient flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 6. Seamless Installation:
 - a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
 - b. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- B. Resilient Sheet Flooring: Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
1. Lay out resilient sheet flooring as follows:
 - a. Maintain uniformity of flooring direction.
 - b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
 - c. Match edges of flooring for color shading at seams.
 - d. Avoid cross seams.
 2. Integral-Flash-Cove Base: Cove resilient sheet flooring to dimension indicated up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
 - a. Install metal corners at inside and outside corners.
- C. Resilient Tile: Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles in pattern indicated on drawings.
 2. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - a. Lay tiles in pattern of colors and sizes indicated.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient flooring.
- B. Perform the following operations immediately after completing resilient flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Cover resilient flooring until Substantial Completion.
 - 1. Linoleum: Cover after allowing drying room film (yellow film caused by linseed oil oxidation) to disappear.

END OF SECTION 09 6500

SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Resilient base.
 2. Resilient molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 RESILIENT BASE AND ACCESSORIES

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings in Material Selection Schedule.

2.3 VINYL MOLDING ACCESSORY

- A. Description: Vinyl cap for cove resilient floor covering reducer strip for resilient floor covering transition strips.
- B. Profile and Dimensions: As indicated.
- C. Locations: Provide vinyl molding accessories in areas indicated.
- D. Colors and Patterns: As indicated on Drawings in Material Selection Schedule..

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
 - a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 6513

SECTION 09 6566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet vinyl flooring.

B. Related Requirements:

1. Section 09 6513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

1.2 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.
5. Seam locations for sheet flooring.

- C. Samples for Initial Selection: For each type of resilient athletic flooring.

1. Game-Line and Marker Paint: Include charts showing available colors and glosses.

- D. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- (150-mm-) square in size and of same thickness and material indicated for the Work.

1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and marker-paint colors applied to flooring.
2. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch (150-by-230-mm) Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For sheet vinyl flooring Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

- A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

1.8 FIELD CONDITIONS

- A. Adhesively Applied Products:
 - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
 - 3. Close spaces to traffic during flooring installation.
 - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Certification: Resilient athletic flooring shall be certified under the RFCI FloorScore program.
- B. Low-Emitting Materials: Flooring system elements shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 RESILIENT ATHLETIC FLOORING

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.3 SHEET FLOORING

- A. Sheet Vinyl Flooring (RAF-1, RAF-2): Sheet vinyl flooring specifically designed for adhered athletic flooring applications.

1. Products: Subject to compliance with requirements, provide products indicated on Drawings.
2. Sheet Vinyl Flooring with Backing: ASTM F 1303.
 - a. Type (Binder Content): Type I, minimum binder content of 90 percent.
 - b. Wear-Layer Thickness: Grade 1.
 - c. Overall Thickness: 6.2 mm.
3. Seaming Method: Heat welded.
4. Traffic-Surface Texture: Insert description.
5. Applied Finish: Factory-applied UV urethane.
6. Roll Size: 78" (2m) wide by longest length that is practical to minimize splicing during installation.
7. Omnisports Multi-Use - Prefabricated sport surface 6.2 mm (0.22") with wood flooring design and slightly textured embossed surface as supplied by Tarkett.
 - a. Embossing of wood design and solid colors must be the same; varying embossing or surface textures will not be allowed.
 - b. Printing of wood design shall closely resemble standard wood strip flooring in size, color, board length, and grain appearance.
 - c. Surface embossing combined with TopClean XP must offer proper balance of surface friction per the ASTM F2772.
 - d. Surface embossing combined with TopClean XP must provide resistance to stains and scratches. Surface profile must not incorporate linear embossing.
 - e. The wood design shall be protected by a clear layer of pure PVC (Polyvinyl Chloride) and TopClean XP, a factory-applied UV cured urethane treatment.
 - f. Extreme Three (3) Layers technology (X3LT) includes Omnisports XCS cushion, glass veil and calendared sheet must offer improved shock absorbing comfort while providing better indentation recovery.
 - g. The XCS cushion force reduction layer shall be high-density closed cell PVC foam with honeycomb embossing, and is applied in one continuous manufacturing process.
 - h. Laminated or adhered foam layers will not be allowed.
 - i. Field constructed products will not be accepted.

2.4 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Trowel-Applied Underlayment: Portland cement-based matrix formulated for skim-coating flooring substrates.

1. Product: Ardex SD-F Feather Finish.
- C. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
 1. VOC Content: Not more than 50 g/L.
- D. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.
 1. VOC Content: Not more than 150 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Provide trowel-applied underlayment over all slabs to receive adhered flooring where existing flooring is removed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FLOORING INSTALLATION

- A. General: Comply with manufacturer's written installation instructions.
 1. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

2. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
 3. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.
- B. Sheet Flooring Installation: Unroll sheet flooring and allow it to stabilize before cutting and fitting.
1. Lay out sheet flooring as follows:
 - a. Maintain uniformity of flooring direction.
 - b. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (150 mm) away from parallel joints in flooring substrates.
 - c. Match edges of flooring for color shading at seams.
 - d. Locate seams according to approved Shop Drawings.
 2. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - a. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 3. Vinyl Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
 - a. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.
 - b. Chemically Bonded Seams: Comply with ASTM F 693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.
- 3.3 GAME LINES AND MARKERS
- A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.
 - B. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
- 3.4 FIELD-APPLIED FINISHES
- A. Apply finish after game-line and marker paint is fully cured.
 - B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.
 - C. Do not cover flooring after finishing until finish reaches full cure.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing flooring installation:
 - 1. Remove adhesive and other blemishes from flooring surfaces.
 - 2. Sweep and vacuum flooring thoroughly.
 - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

- B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6566

SECTION 09 8433 - SOUND-ABSORBING WALL UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing wall panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For unit assembly and installation.
- C. Samples for Verification: For the following products:
 - 1. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
 - 2. Core Material: 12-inch- (300-mm-) square Sample at corner.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Alarms.
 - e. Sprinklers.
 - f. Access panels.
 - 3. Show operation of hinged and sliding components covered by or adjacent to units.

- B. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- C. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.
 - b. Warping of core.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SOUND-ABSORBING WALL UNITS

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings.

2.4 SOUND-ABSORBING WALL UNITS

- A. Sound-Absorbing Wall Panel (AWP-1/2/3): Manufacturer's standard panel construction consisting of cementitious wood fiber panels factory painted.
 1. Product: Subject to compliance with requirements, provide Armstrong Ceiling and Wall Solutions; Tectum.
 2. Panel Shape: Flat.
 3. Color: As indicated on drawings.
 4. Mounting: Direct-attached to substrate, ASTM E795, Type A.
 5. Core: Cementitious-fiber board.
 6. Edge Profile: Chamfered (beveled).
 7. Corner Detail in Elevation: Square with continuous edge profile indicated.
 8. Reveals between Panels: Flush reveals as indicated on Drawings.
 9. Acoustical Performance: Sound absorption NRC of 0.60 to 0.70 according to ASTM C 423 for Type A mounting according to ASTM E 795.
 10. Nominal Overall Panel Thickness: 2 inches (51 mm).
 11. Panel Width: As indicated on Drawings.
 12. Panel Height: As indicated on Drawings.

2.5 MATERIALS

- A. Core Materials: Manufacturer's standard.
- B. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
 1. Screws: Panel manufacturer's screws for direct attachment to substrate indicated. Factory finish or field paint screw heads to match panels.

2.6 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent units.
- D. Installation Tolerances:
 - 1. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.
 - 2. Variation of Joint Width: Not more than 1/16-inch (1.6-mm) variation from hairline in 48 inches (1200 mm), noncumulative.

3.2 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8433

SECTION 09 9123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 05 5213 "Pipe and Tube Railings" for shop [priming] [painting] pipe and tube railings.
 - 4. for shop priming metal gratings.
 - 5. Section 09 9600 "High-Performance Coatings" for tile-like coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with EPA requirements for lead-based paint activities and renovation [for portions of the building built prior to 1978].
- B. Installer Qualifications: Certified by EPA to conduct lead-based paint activities and renovation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: Match colors indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
 - 6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 - 1. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 - 2. Plaster Substrates: Verify that plaster is fully cured.
 - 3. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
 - 2. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
 - 3. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer[.] [**but not less than the following:**]
 - 4. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - 5. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
 - 6. Aluminum Substrates: Remove loose surface oxidation.
 - 7. Wood Substrates:

- a. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - b. Sand surfaces that will be exposed to view, and dust off.
 - c. Prime edges, ends, faces, undersides, and backsides of wood.
 - d. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
8. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 INSTALLATION

- A. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Existing Buildings: Where new finishes are indicated in existing spaces, paint all existing previously painted items including but not limited to, doors and frames, fire extinguisher cabinets, mechanical devices, electrical panels, and similar items.
- B. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Tanks that do not have factory-applied final finishes.
 - b. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.

- b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces flat black.

3.4 FIELD QUALITY CONTROL

- A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
1. Water-Based Light-Industrial Coating System, MPI INT 3.1L: Apply the following where pre-catalyzed epoxy (PCE) is indicated:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - 1) Sherwin Williams; Loxon, Loxon Concrete & Masonry Primer, A24W8300. .
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.

- c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
 - 1) Product: Subject to compliance with requirements, provide one of the following:
 - a) Behr Paint; Behr Pro HPC Pre-Catalyzed WB Epoxy Eggshell, HP140.
 - b) Benjamin Moore; Corotech Pre-Catalyzed Epoxy Eggshell, V342.
 - c) PPG Architectural; PPG Paints Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed WB Acrylic Epoxy.
 - d) Sherwin Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45W00151.
 - 2) VOC Content: E Range of E2.
 - 3) Environmental Performance Rating: EPR 3.5.

B. CMU Substrates:

1. Water-Based Light-Industrial Coating System, MPI INT 4.2K: Apply the following where pre-catalyzed epoxy (PCE) is indicated:
 - a. Block Filler: Latex, interior/exterior, MPI #4.
 - 1) Product compatible with topcoat by same manufacturer. .
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
 - 1) Product: Subject to compliance with requirements, provide one of the following:
 - a) Behr Paint; Behr Pro HPC Pre-Catalyzed WB Epoxy Eggshell, HP140.
 - b) Benjamin Moore; Corotech Pre-Catalyzed Epoxy Eggshell, V342.
 - c) PPG Architectural; PPG Paints Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed WB Acrylic Epoxy.
 - d) Sherwin Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45W00151.

C. Steel Substrates:

1. Water-Based Light-Industrial Coating System, MPI INT 5.1B: Apply the following where pre-catalyzed epoxy (PCE) is indicated
 - a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - 1) Product compatible with topcoat and by the same manufacturer.
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
 - 1) Product: Subject to compliance with requirements, provide one of the following:
 - a) Behr Paint; Behr Pro HPC Pre-Catalyzed WB Epoxy Eggshell, HP140.
 - b) Benjamin Moore; Corotech Pre-Catalyzed Epoxy Eggshell, V342.
 - c) PPG Architectural; PPG Paints Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed WB Acrylic Epoxy.
 - d) Sherwin Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45W00151.

D. Wood Substrates: Exposed Framing.

1. Institutional Low-Odor/VOC Latex System, MPI INT 6.2L:
 - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
 - 1) VOC Content: E Range of E2.
 - 2) Environmental Performance Rating: EPR 3.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
 - 1) VOC Content: E Range of E3.
 - 2) Environmental Performance Rating: EPR 4.5.

E. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System, MPI INT 9.2M: Apply the following to ceilings unless indicated otherwise:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - 1) VOC Content: E Range of E3.
 - 2) Environmental Performance Rating: EPR 3.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), MPI #143.
 - 1) VOC Content: E Range of E3.
 - 2) Environmental Performance Rating: EPR 4.
2. Institutional Low-Odor/VOC Latex System, MPI INT 9.2M: Apply the following to walls unless indicated otherwise:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - 1) VOC Content: E Range of E3.
 - 2) Environmental Performance Rating: EPR 3.
 - b. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.
 - 1) VOC Content: E Range of E3.
 - 2) Environmental Performance Rating: EPR 4.5.
3. Water-Based Light-Industrial Coating System[, **MPI INT 9.2L**]: Apply the following where pre-catalyzed epoxy (PCE) is indicated:
 - a. Prime Coat: Primer sealer, latex, interior[, **MPI #50**].
 - b. Intermediate Coat: Light-industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light-industrial coating, interior, water based (MPI Gloss Level 3)[, **MPI #151**].
 - 1) Product: Subject to compliance with requirements, provide one of the following:

- a) Behr Paint; Behr Pro HPC Pre-Catalyzed WB Epoxy Eggshell, HP140.
- b) Benjamin Moore; Corotech Pre-Catalyzed Epoxy Eggshell, V342.
- c) PPG Architectural; PPG Paints Pitt-Glaze WB1 Interior Eggshell Pre-Catalyzed WB Acrylic Epoxy.
- d) Sherwin Williams; Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45W00151.

F. Acoustic Panels and Tiles:

1. Alkyd, Flat System[, **MPI INT 9.3C**]:
 - a. Prime Coat: Alkyd, interior, matching topcoat.
 - b. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1)[, **MPI #49**].

END OF SECTION 09 9123

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
1. Exterior Substrates:
 - a. Galvanized metal.
 2. Interior Substrates:
 - a. Concrete masonry units (CMUs).
- B. Related Requirements:
1. Section 05 1213 "Architecturally Exposed Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
 2. Section 05 5213 "Pipe and Tube Railings" for shop painting pipe and tube railings with coatings specified in this Section.
 3. Section 09 9113 "Exterior Painting" for general field painting.
 4. Section 09 9123 "Interior Painting" for general field painting.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with EPA requirements for lead-based paint activities and renovation for portions of the building built prior to 1978.
- B. Installer Qualifications: Certified by EPA to conduct lead-based paint activities and renovation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
- D. Colors: As follows:
 - 1. Exterior:
 - a. Where colors are not indicated, provide colors as selected by Architect from manufacturer's full range.
 - 2. Interior:
 - a. Colors: As indicated in color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Masonry (Clay and CMUs): 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or alkalinity of mortar joints exceeds that permitted in manufacturer's written instructions.

- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Galvanized-Metal Substrates:
 - 1. Pigmented Polyurethane over Vinyl Wash Primer and Epoxy Primer System MPI EXT 5.3D:
 - a. Prime Coat: Primer, vinyl wash, MPI #80.
 - 1) VOC Content: E Range of E2.
 - b. Intermediate Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.

- 1) VOC Content: E Range of E2.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. CMU Substrates:

1. Epoxy-Modified Latex System MPI INT 4.2J:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - 1) VOC Content: E Range of E3.
 - b. Intermediate Coat: Epoxy-modified latex, interior, matching topcoat.
 - a. Topcoat: Epoxy-modified latex, semi-gloss (MPI Gloss Level 5), MPI #215.
 - 1) VOC Content: E Range of E3.

END OF SECTION 09 9600

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SECTION 10 1426 - POST AND PANEL/PYLON SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonilluminated post-and-panel signs.
2. Internally illuminated post-and-panel signs.
3. Internally illuminated exterior monumental signs

B. Related Requirements:

1. Section 01 2100 "Allowances" for lump sum allowance for exterior signs provided under this section.
2. Section 03 3000 "Cast-in-Place Concrete" for concrete foundations, concrete fill in postholes, and setting anchor bolts in concrete foundations for signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signage.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly, showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Post-and-Panel Signs: Not less than 12 inches (300 mm) square, including corner and post.
2. Variable Component Materials: 8-inch (200-mm) Sample of each base material, character or graphic element, in each exposed color and finish not included in other Samples.
3. Exposed Accessories: Half-size Sample of each accessory type.
4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For post-and-panel signs. Use same designations indicated on Drawings or specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
- B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- C. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 POST-AND-PANEL & MONUMENT SIGNS

- A. Post-and-Panel Sign: Sign of hollow-box configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Postema Signs & Graphics
 - b. ASI Sign Systems, Inc.
 - c. SignComp
 - d. Valley City Signs.
 - e. Universal Sign Systems.
 2. Solid-Sheet Sign Panels, Returns, and Back: Aluminum sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph and as follows:
 - a. Thickness: 0.125 inch (3.18 mm).
 - b. Surface-Applied Graphics: Applied vinyl film and/or baked enamel or powder coat. Back side of each exposed sign panel shall be coated to match post.
 - c. Inset, Cutout Characters: Sign face routed to receive push-through acrylic graphics flush with the sign panel.
 3. Single-Panel Sign Frame: Entire perimeter.
 - a. Material: Aluminum.
 - b. Material Thickness: As indicated on Drawings
 - c. Frame Depth: As indicated on Drawings.
 - d. Profile: Square.
 - e. Corner Condition in Elevation: Square.
 - f. Finish and Color: Match sign-panel face, and as selected by Architect from manufacturer's full range.
 4. Hollow-Box Sign Frame: Entire perimeter framed with formed-aluminum sheet or extruded-aluminum, hollow-box-type frame with vertical edges attached to supports with aluminum fittings. Close top and bottom edges of panels with manufacturer's standard welded seams or extrusions.
 - a. Hollow-Box Depth: Same depth as posts.
 - b. Profile: Square.
 - c. Corner Condition in Elevation: Square.
 - d. Finish and Color: Match sign-panel face, and as selected by Architect from manufacturer's full range.
 5. Sign-Frame Mounting: Between posts.
 6. Multiple-Message Bars and Inserts: Fixed message bars capable of receiving changeable messages in the form of slide-in, aluminum changeable inserts. Provide initial messages as indicated on Drawings.
 7. Posts: Aluminum.
 - a. Shape: Square.
 - b. Size: 3 by 3 inches (75 by 75 mm).
 - c. Installation Method: Direct burial.
 - d. Finish and Color: Match sign-panel face, ad as selected by Architect from manufacturer's full range.

8. Sign-Panel-Face Finish and Applied Graphics:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - d. Overcoat: Manufacturer's standard baked-on clear coating.
9. Text and Typeface: typeface as selected by Architect from manufacturer's full range and variable content as scheduled.

2.3 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Steel Materials:
 - 1.
 2. Hot-Rolled, Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M.
 3. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi (290-MPa) minimum yield strength.
 4. Steel Tubing or Pipe: ASTM A 500/A 500M, Grade B.
 5. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 (ASTM A 325M) as necessary for design loads and connection details.
 6. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
- D. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.
- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

- b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.
 4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58, or ICC-ES AC308 as appropriate for the substrate.
 1. Uses: Securing signs with imposed loads to structure.
 2. Type: Torque-controlled, expansion anchor.
 3. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Anchoring Materials:
 1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
 2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - a. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
 2. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed fasteners where they will be inconspicuous.
 5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

- B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
 - 1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
 - 2. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
 - 3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

- C. Post Fabrication: Fabricate posts designed for structural performance indicated and of lengths required for installation method indicated for each sign.
 - 1. Aluminum Posts: Manufacturer's standard 0.125-inch- (3.18-mm-) thick, extruded-aluminum tubing unless otherwise indicated, with brackets or slots to engage sign panels. Include a water-excluding cap on top of post of same material and color.
 - 2. Concrete Footing: Fabricate posts 43 inches longer than height of sign to permit placement within concrete-filled postholes at 42 inch depth from finish grade. Posts to extend 1" beyond concrete to allow for water drainage that might get into posts.

2.6 FINISH REQUIREMENTS

- A. General: Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
 - 1. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - 2. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
 - 3. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

- B. Aluminum Finishes:
 - 1. Depending on final approved color selections from shop drawing process, use the corresponding of the two options:
 - a. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
 - b. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs at heights indicated on Drawings.
3. Install signs so they do not protrude or obstruct according to the accessibility standard.
4. Before installation, verify that sign components are clean and free of materials or debris that would impair installation.
5. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING POSTS

- A. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
- B. Sleeve in Concrete Method:
 1. Excavation: Excavate posthole to dimensions indicated; sonotube use is acceptable. Reconstruct subgrade that is not firm, undisturbed, or compacted soil, or that is damaged by freezing temperatures, frost, rain, accumulated water, or construction activities by excavating an additional 12 inches (300 mm), backfilling with satisfactory soil or well-graded aggregate, and compacting to original subgrade elevation.
 2. Setting PVC sleeve in Cast-in-Place Concrete: Install a PVC pipe cut to fit in concrete footing not less than 3/4 inch larger than outside dimension of post. Set sleeve in position, support to prevent movement, and place concrete in posthole around sleeve. Ensure sleeve is plumb, level, and in center of concrete footing.
 3. Setting Sign Post in PVC sleeve hole:
 - a. Set sign post in position within sleeve to depth indicated on drawings.
 - b. Shim to prevent movement, and fill annular space between post and hole with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with manufacturer's written instructions.
 - c. Leave anchorage joint exposed with anchoring material flush with adjacent surface.
 - d.
 4. Cleanup:
 - a. Remove protective film entirely from sign panel faces, clean off any other miscellaneous shipping residue or concrete splash with product recommended by manufacturer.
 - b. Cut off and remove any left-over sonotube visible above finish grade.

END OF SECTION 10 1426

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SECTION 10 1453 - TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes traffic signs.
- B. Related Sections include the following:
 - 1. Division 10 Section "Signage" for building signage.
 - 2. Division 10 Section "Post and Panel/Pylon Signs" for sight identification signage.
 - 3. Division 31 Section "Earth Moving" for excavation and backfilling.

1.2 SUBMITTALS

- A. Product Data: For each type of sign.
- B. Material Certificate: Signed by manufacturer stating that products comply with the requirements.

1.3 QUALITY ASSURANCE

- A. Comply with MDOT standards.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B 209, 6061-T6, minimum 0.080 inch(2.0 mm) thick.
- B. Reflective Sign Graphic and Coating: In conformance with MDOT standards.
- C. Post: ASTM A702 Type A or Type B steel, hot-dip galvanized after fabrication in accordance with MDOT standards and as follows:
 - 1. Square Tube Posts: **[2-inch(51-mm)] [3-inch(76-mm)]** square with 3/16-inch(4.8-mm) minimum wall thickness.
 - 2. "U" channel with minimum 2-inch(51-mm) face width.
- D. Post Sleeve: 4-inch(102-mm) diameter PVC pipe.
- E. Concrete: In accordance with Division 03 Section "Cast-In-Place Concrete" with not less than 3000-psi(20.7- MPa) compressive strength (28 days).
- F. Concrete: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water.

1. Concrete Mixes: Normal-weight concrete[**air entrained**] with not less than 3000-psi(20.7- MPa) compressive strength (28 days), 3-inch(75-mm) slump, and 1-inch(25-mm) maximum size aggregate.

2.2 SIGNS

- A. Fabricate signs with graphics and in sizes as indicated on Drawings, in accordance with MDOT standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount signs with posts plumb in accordance with MDOT standards at heights indicated on Drawings. Imbed posts as indicated on Drawings.
 1. Signs Mounted in Soil: Firmly pack soil around sign post for rigid installation.
 2. Signs Mounted in Concrete Footings: Set post in sleeve cast into concrete. Firmly pack sand in space between sign and sleeve.

END OF SECTION 10 1453

SECTION 11 6800 - PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. National Federation of State High School Associations (NFSHSA)
2. National Collegiate Athletic Association (NCAA)
3. International Amateur Athletic Foundation (I.A.A.F.)
4. American Sports Builders Association
5. Manufacturers Data and Recommended Installation Requirements.

1.3 SUMMARY

- A. Section includes playground equipment as follows:
 1. Tennis court equipment.
 2. Softball Field Equipment

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of equipment.
- C. Samples for Initial Selection: For each type of exposed finish.
 1. Manufacturer's color charts.
 2. Include Samples of accessories involving color selection.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For equipment and finishes to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Tennis Net Post

1. Basis of Design: Douglas Sports, Model DTP-37 Tennis Posts, 3-inch Outside Diameter, standard "black" color, SKU #63008.

B. Net Post Ground Sleeve

1. Basis of Design: Douglas Sports, Model GS-24RD Galvanized Steel Ground Sleeves 24" Long for 3-inch O.D. Posts, SKU #63424. Includes PVC end plugs. Sold per pair.

C. Center Pipe Anchor (for center strap hold-down)

1. Basis of Design: Douglas Sports, 1.9" O.D. Galvanized Steel, SKU #63428.

D. Tennis Net

1. Basis of Design: Douglas Sports, Model TN-45 Tennis Net, 3.5mm with Polyester Headband, SKU #20045.

E. Tennis Net Center Strap

1. Basis of Design: Douglas Sports, 2-inch Polyester white web with Velcro adjustment, SKU #20601.

F. Moveable Aluminum Bleacher

G. Softball Field Batting Cages:

1. BCI (Batting Cages Inc) - Baseball/Softball Equipment – Mastodon Engineered Batting Cage System by BCI OR EQUAL.
 - a. Provide (1) Baseball tunnel – size 14'W x 70'L x 12'H
 - b. Provide (1) Softball tunnel – size 14'W x 55'L x 12'H
 - c. Refer to manufacturers instructions for components necessary to install a complete batting cage system.
 - d. Single stall option
 - e. Cable tensioning system
 - f. Galvanized steel carabiners
 - g. #42 Bear Trap Net
 - h. 20 Year Warranty
 - i. Structural steel poles with corrosion resistant coating
 - j. Corrosion Resistant Coating; All poles are corrosion dipped, finished with STRYK 5388, and sealed with a welded top cap preventing internal corrosion. STRYK 5388 forms a solid coating which bonds to the substrate, preventing corrosion even if the coating is scratched or damaged.

- k. Cable Tensioning System; cable tensioning system to use galvanized hardware including 3/16" aircraft cable, cable clamps, thimble eye nuts, eye bolts, institutional grade threaded rod, and curved washers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor equipment securely, positioned at locations and elevations indicated.
- B. Post Set with Concrete Footing: Comply with Section 03 3000 "Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.
 1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
 - a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
 2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.
 3. Finishing Footings: Smooth top, and shape to shed water.

END OF SECTION 11 6800

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SECTION 12 3623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For plastic-laminate-clad countertops. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
- C. Samples for Initial Selection: For plastic laminates.
 - 1. Countertop edge material.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.5 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
- B. Grade: Custom in accordance with AWI.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by manufacturer's designations on Drawings.
- E. Edge Treatment: 3-mm (0.12 inch) PVC edging.
 - 1. Product: As indicated on Drawings.
- F. Core Material: As selected by fabricator to comply with quality standard.
 - 1. Core Material at Sinks: Particleboard made with exterior glue or exterior-grade plywood.
 - 2. Core Thickness: 1-1/8 inch (29 mm).
 - a. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- G. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
 - 1. Particleboard: ANSI A208.1, Grade M-2 and Grade M-2-Exterior Glue.

2.3 ACCESSORIES

2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
 1. Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches (3-mm-in-2400-mm) variation from a straight, level plane.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**PLASTIC-LAMINATE-CLAD COUNTERTOPS
12 3623.13 - 4
12/21/2022**

- F. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 12 3623.13

SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeve-seal systems.
4. Sleeves.
5. Stack-sleeve fittings.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.2 ACTION SUBMITTALS

A. Product Data: For dielectric fittings.

1.3 QUALITY ASSURANCE

- A. Provide plumbing systems, equipment, and materials in accordance with applicable codes and regulations, and with authorities having jurisdiction.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to

prevent damage during shipment, storage, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.5 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and sleeves in structural components.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BA91, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded end connections that match piping system materials.
 - 1. Insulating Material: Suitable for system fluid, pressure, and temperature.

- B. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig(1725-kPa) minimum working pressure at 180 deg F(82 deg C) with threaded end connections.
- C. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig(2070-kPa) minimum working pressure at 225 deg F(107 deg C).
- D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig(2070-kPa) minimum working pressure at 225 deg F(107 deg C).

2.4 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Plastic.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.5 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.6 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.

- C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.
- F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.8 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.9 PLUMBING ROOF PENETRATIONS

- A. Pipe Curbs for Single or Multiple Pipe Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, wood nailer, and acrylic clad ABS plastic cover(s), PVC boot(s), and stainless steel clamps.. Size as required to suit roof opening and piping. Overall minimum height shall be 12 inches above roof insulation. Pate or equivalent.
 - 1. Provide curbs with level tops and bottoms to match roof slope.
- B. Pipe Curbs for Single Pipe Penetrations: All roof pipe penetrations up to 10" O.D. shall be flashed and sealed using a Pate or equivalent pipe seal, consisting of a spun aluminum base having a minimum five inch roof surface flange, a stepped polyvinyl chloride boot to be secured to the base and the pipe with adjustable stainless steel clamps as furnished.
 - 1. Provide curbs with bottoms to match roof slope.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. During domestic water demolition, eliminate all "dead-leg" sections.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
1. Drawings are diagrammatic with no attempt made to show every ell, tee, transition, fitting, or appurtenance. Provide installations that are complete in every detail, compliant with all applicable codes, and as required to provide a fully functional and operational system even though every item is not specifically indicated.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:
1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
 2. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
 - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

3.4 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
1. Sleeves are not required for core-drilled holes.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.5 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.
- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls Above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.

- b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Stack-sleeve fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Stack-sleeve fittings.
 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

3.8 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.
- I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.9 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2(DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2(DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Wet Piping Systems: Install dielectric unions, dielectric coupling, or dielectric nipple fittings to connect piping materials of dissimilar metals.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Sequence, coordinate, and integrate installations of plumbing equipment.
- B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- E. Install equipment to allow right of way for piping installed at required slope.

- F. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.
- G. Verify final equipment locations for roughing-in.
- H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.11 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches(100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch(450-mm) centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi(20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete."

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.14 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 - 1. Clean surfaces that will come into contact with grout.
 - 2. Provide forms as required for placement of grout.
 - 3. Avoid air entrapment during placement of grout.
 - 4. Place grout, completely filling equipment bases.

5. Place grout on concrete bases and provide smooth bearing surface for equipment.
6. Place grout around anchors.
7. Cure placed grout.

3.15 PLUMBING ROOF PENETRATIONS

- A. Install plumbing roof penetrations in accordance with roof curb manufacturer's recommendations and in strict compliance with roofing manufacturer's requirements.
 1. Roofs with Warranty: Roof penetrations and curbs shall be installed in such a manner to maintain roofing warranty.
- B. Pipe Curbs for Pipe Penetrations: Secure boot to curb base and secure boot to pipe with adjustable stainless steel clamps.

3.16 INSTALLATION OF ACCESS DOORS

- A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
 2. Adjust hardware and panels after installation for proper operation.

3.17 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 0500

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SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.
- B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet(1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
 - 1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Class B.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Manufacturer's standard material.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Shaft Grounding Ring: Factory installed shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.

3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONIC COMMUTATION MOTOR (ECM)

- A. Description: Motor to be an electronic commutation motor (ECM) specifically designed for direct drive applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the equipment load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 22 0513

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SECTION 22 0519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. NSF Compliance as required by authorities having jurisdiction:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
 - 3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft Inc.
 - 2. Miljoco Corporation.
 - 3. Trelice, H. O. Co.
 - 4. Weiss Instruments, Inc.

5. Weksler Glass Thermometer Corp.
- B. Case: Metal or plastic, 9 inches(229 mm) long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Thermowells:
 1. Standard: ASME B40.200.
 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 3. Type: Stepped shank unless straight or tapered shank is indicated.
 4. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25), ASME B1.20.1 pipe threads.
 5. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
 6. Bore: Diameter required to match thermometer bulb or stem.
 7. Insertion Length: Length required to match thermometer bulb or stem.
 8. Lagging Extension: Include on thermowells for insulated piping and tubing.
 9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- C. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ashcroft Inc.
 2. Marsh Bellofram.
 3. Miljoco Corporation.
 4. Terice, H. O. Co.
 5. Weiss Instruments, Inc.
 6. Weksler Glass Thermometer Corp.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Standard: ASME B40.100.
2. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch(114-mm) diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, NPS 1/4(DN 8), bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer with front recalibration.
6. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
7. Pointer: Red or other dark-color metal.
8. Window: Glass or plastic.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
11. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure(100 kPa of vacuum to 103 kPa of pressure).
12. Range for Fluids under Pressure: Two times operating pressure.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Tubing: NPS 1/4(DN 8) copper.
- C. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATIONS

- A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- E. Fill thermowells with heat-transfer medium.
- F. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
 1. Provide elbows as required to install gauges at location and angle readable from standing position on floor.
- G. Install valve and snubber in piping for each pressure gage for fluids.

- H. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlet and outlet of each domestic hot-water storage tank.
 - 3. Where located on piping schematics within the drawing set.
- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
 - 4. Where located on piping schematics within the drawing set.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Plastic case, industrial-style, liquid-in-glass type.
 - 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- A. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
 - 1. Plastic case, industrial-style, liquid-in-glass type.
 - 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C).

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Sealed, direct-mounted, plastic case.

2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
 - A. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 1. Sealed, direct-mounted, plastic case.
 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
 - A. Pressure gages at suction and discharge of each domestic water pump shall be the following:
 1. Sealed, direct-mounted, plastic case.
 2. Test plug with chlorosulfonated polyethylene synthetic or EPDM self-sealing rubber inserts.
- 3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE
- A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).
 - B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

END OF SECTION 22 0519

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SECTION 22 0523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Bronze ball valves.
2. Iron, lug type butterfly valves.
3. Copper, grooved-end butterfly valves.
4. Iron, grooved-end butterfly valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Iron, grooved-end swing check valves.

- B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.
 1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance as required by authorities having jurisdiction:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
 - 3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect valve ends from damage.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. Refer to valve schedule articles for applications of valves.
- C. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.

5. ASME B31.9 for building services piping valves.
- D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- E. NSF Compliance: NSF 61 and NSP 372 for valve materials for potable-water service.
- F. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.
- G. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- H. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- I. Valve Sizes: Same as upstream piping unless otherwise indicated.
- J. Valve Bypass and Drain Connections: MSS SP-45.
- K. Valve Actuator Types:
 1. Handwheel: For valves other than quarter-turn types.
 2. Handlever: For quarter-turn valves NPS 6(DN 150) and smaller.
 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 3 plug valves, for each size square plug-valve head.
- L. Valves in Insulated Piping: Valves in domestic cold water lines with more than 1/2-inch(13-mm) insulation shall include the following:
 1. Ball Valves: Stem extensions or extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 2. Butterfly Valves: Extended neck.
- M. Valve-End Connections:
 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to manufacturer.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. Jomar.
 - e. Milwaukee Valve Company.

- f. NIBCO INC.
- g. WATTS.
- h. Zurn Industries, LLC.

2. Description:

- a. Standard: MSS SP-110 or MSS-145.
- b. CWP Rating: 600 psig(4140 kPa).
- c. Body Design: Two piece, threaded.
- d. Body Material: Bronze.
- e. Ends: Threaded, press, and soldered.
- f. Press Ends Connections Rating: Minimum 200 psig (1380 kPa).
- g. Seats: PTFE.
- h. Stem: Bronze.
- i. Ball: Bronze.
- j. Port: Full.

2.3 IRON, LUG TYPE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Flow Controls; Conbraco Industries, Inc.
 - b. DeZURIK.
 - c. Flo Fab Inc.
 - d. Legend Valve & Fitting, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. WATTS.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig(1380 kPa).
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

2.4 COPPER, GROOVED-END BUTTERFLY VALVES

A. Copper, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company.
- 2. Description:
 - a. Maximum Working Pressure: 300 psig(2070 kPa).
 - b. Body Material: Bronze or brass, lead free.

- c. Stem: One or two-piece stainless steel.
- d. Disc: Aluminum bronze or encapsulated ductile iron.
- e. Seal: EPDM.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig(1200 kPa).
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Aluminum bronze.
 - f. Seal: EPDM.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. WATTS.
- 2. Description:
 - a. Standard: MSS SP-139.
 - b. CWP Rating: 200 psig(1380 kPa).
 - c. Body Design: Horizontal flow.
 - d. Body Material: Bronze.
 - e. Ends: Threaded, press, or soldered. See valve schedule articles.
 - f. Press Ends Connection Rating: Minimum 200 psig (1380 kPa).
 - g. Disc: Bronze.

B. Class 125, Bronze Swing Y-Pattern Check Valves with Nonmetallic Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.

- e. NIBCO INC.
- f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

- 2. Description:
 - a. Standard: MSS SP-80.
 - b. Body Design: Horizontal flow.
 - c. Body Material: Bronze.
 - d. Ends: Threaded.
 - e. Disc: PTFE.

2.7 IRON SWING CHECK VALVES

A. Class 150, Iron Swing Check Valves with Metal Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:
 - a. Standard: MSS SP-136.
 - b. CWP Rating: 250 psig(1724 kPa).
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 395, ductile iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Stainless steel.
 - g. Gasket: Asbestos free.

2.8 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Victaulic Company.
- 2. Description:
 - a. CWP Rating: 300 psig(2070 kPa).
 - b. Body Material: ASTM A 536, ductile iron.
 - c. Seal: EPDM.
 - d. Disc: Spring-operated, ductile iron or stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Check Valves: Install check valves for proper direction of flow.
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Plate-Type Check Valves: In horizontal or vertical position, between flanges.
- F. Install valve tags. Comply with requirements in Section 22 0553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

- A. Adjust or replace leaking valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.

- b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with, metal-seat check valves.

B. End Connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded or soldered or press-ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged.
4. For Grooved-End Copper Tubing: Grooved.

C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

D. Select valves with the following end connections:

1. For Copper Tubing, NPS 2(DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4(DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Grooved-End Copper Tubing: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2(DN 50) and Smaller:

1. Ball Valves:
 - a. Two piece, full port, bronze with bronze trim.
 - b. May be provided with solder-joint ends instead of threaded ends.
2. Check Valves:
 - a. Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.
 - b. Bronze swing check valves with press-end connections.

B. Pipe NPS 2-1/2(DN 65) and Larger:

1. Butterfly Valves:
 - a. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze disc.
 - b. Copper, Grooved-End Butterfly Valves: 300 psig maximum working pressure, aluminum-bronze or encapsulated disc.
 - c. Ductile-Iron, Grooved-End Butterfly Valves: 300 CWP.
2. Check Valves:
 - a. Iron swing check valves with metal seats, Class 150, with flanged end connections.
 - b. Iron, grooved-end swing check valves, 300 CWP.

3.6 VALVE APPLICATIONS:

A. Domestic Water:

1. Shutoff Service: Ball and butterfly valves.
2. Throttling Service: Ball and butterfly valves.
3. Check Valves:
 - a. NPS 2(DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.
 - b. NPS 2-1/2(DN 65) and Larger: Iron swing type check valves with metal seat.

END OF SECTION 22 0523

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SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe positioning systems.
- B. Related Requirements:
 - 1. See Division 21 fire-suppression sections for pipe hangers for fire-suppression piping.
 - 2. Section 05 5000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- #### A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

- #### A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- #### B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches(50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Indoor Applications: Zinc-coated steel.
 - 2. Outdoor Applications: Stainless steel.

2.6 MISCELLANEOUS MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M).
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi(34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2(DN 8 to DN 90): 12 inches(305 mm) long and 0.048 inch(1.22 mm) thick.
 - b. NPS 4(DN 100): 12 inches(305 mm) long and 0.06 inch(1.52 mm) thick.
 - c. NPS 5 and NPS 6(DN 125 and DN 150): 18 inches(457 mm) long and 0.06 inch(1.52 mm) thick.
 - d. NPS 8 to NPS 14(DN 200 to DN 350): 24 inches(610 mm) long and 0.075 inch(1.91 mm) thick.
 - e. NPS 16 to NPS 24(DN 400 to DN 600): 24 inches(610 mm) long and 0.105 inch(2.67 mm) thick.
 1. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 2. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches(40 mm) maximum.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use thermal-hanger shield inserts for insulated piping and tubing.
- G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30(DN 15 to DN 750).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F(49 to 232 deg C) pipes, NPS 4 to NPS 16(DN 100 to DN 400), requiring up to 4 inches(100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24(DN 20 to DN 600), requiring clamp flexibility and up to 4 inches(100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
 - 5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8(DN 15 to DN 200).

6. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30(DN 15 to DN 750).
 7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 8. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36(DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
 9. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30(DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 10. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42(DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20(DN 20 to DN 500).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20(DN 20 to DN 500), if longer ends are required for riser clamps.
- I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches(150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F(49 to 232 deg C) piping installations.
- J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb(340 kg).
 - b. Medium (MSS Type 32): 1500 lb(680 kg).
 - c. Heavy (MSS Type 33): 3000 lb(1360 kg).
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches(32 mm).
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
- M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
1. Use powder-actuated fasteners only in concrete construction that is suitable for their installation.
- P. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 0529

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Stencils.
 - 4. Valve tags.

1.3 ACTION SUBMITTALS

- A. Valve Schedules: For each piping system.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 "Pipe Labeling Guide" for color scheme, length of field and letter height.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch(1.6 mm) thick, and having predrilled holes for attachment hardware.
 - 2. Letter Color: Black.

3. Background Color: White.
 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F(71 deg C).
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch(64 by 19 mm).
 - a. Size of label shall be proportional to equipment size.
 6. Minimum Letter Size: 1/4 inch(6.4 mm) for name of units if viewing distance is less than 24 inches(600 mm), 1/2 inch(13 mm) for viewing distances up to 72 inches(1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 7. Fasteners: Stainless-steel rivets or self-tapping screws.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic label including flow arrow formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include flow arrow label with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service matching designations or abbreviations as used on Drawings.

2.3 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch(19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil Material: Fiberboard or metal.
 2. Stencil Paint: Exterior, gloss, black enamel unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch(6.4-mm) letters for piping system abbreviation and 1/2-inch(13-mm) numbers.
 1. Tag Material: Brass, 0.032-inch(0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain; or S-hook.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch(A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Provide glass front frame for each valve schedule for mounting in building mechanical room.
 - 2. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Pipe Label Applications: Install pipe labels as follows:
 - 1. Use pretensioned pipe labels or self-adhesive pipe labels.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:
 - 1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet(15 m) along each run.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Install glass front frame valve schedule in building mechanical room. Locate at Owners representative approved location.

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulation materials for plumbing systems:
- B. Related Sections:
 - 1. Division 23 Section "HVAC Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated below. Include thermal conductivity, water-vapor permeance, thickness, and jackets (if any).
 - 1. Insulation Materials:
 - a. Mineral fiber.
 - b. Flexible elastomeric.
 - 2. Field-applied jackets.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application.
 - 1. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville.
 - b. Knauf Insulation.
 - c. Owens Corning.
 - 2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS AND COATINGS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
 - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM 96, greater than 1.0 perm (0.66 metric perms) at manufacturer's recommended dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Color: White.

2.5 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Fitting Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.

- C. Self-Adhesive Outdoor Jacket: Minimum 40-mil-(1.0-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.
1. Coordinate color of optional colors with Architect and Owner.
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard; Alumaguard.
 - b. MFM Building Products; Flex Clad 400

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
 2. Thickness: 11.5 mils (0.29 mm).
 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive.
1. Width: 2 inches (50 mm).
 2. Thickness: 6 mils (0.15 mm).
 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.9 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- B. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

- a. For below-ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation at roof structure and seal with joint sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations:
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant.
 - 3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches(50 mm).
 - 5. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For mineral fiber insulation, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- 1. Flexible elastomeric pipe insulation only allowed in concealed or mechanical room locations.

- B. Insulation Installation on Pipe Flanges:

- 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:

- 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC fitting jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
2. Fill inside of fitting jackets to prevent collapse of jacket.

3.9 FINISHES

A. Paintable Jacket Material: Paint jacket with paint system identified in Division 09 painting Sections.

B. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable pipe insulation materials and thicknesses are identified for each piping system and pipe size range.
 - 1. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Chrome-plated pipes and fittings.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
 - 2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
 - 2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
- C. Condensate and Equipment Drain Water below 60 Deg F(16 Deg C) Located in Ceiling Space:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch(25 mm) thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.
- D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Pipe Fittings with Mineral Fiber Insulation:
 - 1. PVC Fitting Covers: 20 mils(0.6 mm) thick, white.

PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT

PLUMBING INSULATION
22 0700 - 12
12/21/2022

END OF SECTION 22 0700

SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.
 - 2. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig (860 kPa), unless otherwise indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Water Samples: Specified in Part 3 "Cleaning" Article.
- B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- C. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

1.7 REGULATORY REQUIREMENTS

- A. Comply with the provisions of the following:
 1. Michigan Plumbing Code.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.
- C. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K (ASTM B 88M, Types A), water tube, annealed temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- B. Hard Copper Tube: ASTM B 88, Types L (ASTM B 88M, Types B), water tube, drawn temper.
 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 4. Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.
 - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for domestic water, and bolts and nuts.
 - b. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Victaulic Company of America.

2.3 PEX TUBE AND FITTINGS

- A. PEX Distribution System: Crosslinked polyethylene (PEX), manufactured in accordance with ASTM F876 and ASTM F877.
 - 1. Fittings: ASTM F1960 metal cold expansion or ASTM F 1807, metal insert and crimp rings.
 - 2. Pressure/Temperature Rating: Minimum 100 psig(690 kPa) and 180 deg F(82 deg C).
 - 3. Provide pre-insulated PEX for underslab applications.

2.4 MECHANICAL JOINT COPPER PRESS FITTING SYSTEM

- A. At the Installer's option, mechanical joint copper press fitting system using Type L copper tubing may be used for 4 inch and smaller above ground domestic water systems in lieu of soldered or threaded connections as specified.
- B. Provide manufacturer's standard mechanical joint copper press fittings and couplings which are suitable for the temperature range and operating pressures specified for each system and have the approval of state and local codes having jurisdiction.
- C. Fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for fittings shall be EPDM.
- D. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1. Ridgid/Viega "ProPress"
 - 2. NIBCO "Press"
 - 3. Apollo "Xpress"

2.5 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
1. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
2. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
1. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
2. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
1. Pressure Rating: 150 psig (1035 kPa).
2. Gasket: Neoprene or phenolic.
3. Bolt Sleeves: Phenolic or polyethylene.
4. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
1. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
2. End Connections: Male threaded or grooved.
3. Lining: Inert and noncorrosive, propylene.

2.7 VALVES

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Balancing and drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 31 2000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping," and drain valves and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Include a backflow preventer as required by local authority having jurisdiction.
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- A. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 1119 "Domestic Water Piping Specialties."
- A. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 1123 "Domestic Water Pumps."
- B. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 0519 "Meters and Gages for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- C. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- F. Press Connections: Copper press fitting connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

- H. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
 - 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
 - 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - 5. NPS 3 to NPS 4 (DN 80 to DN 100): 10 feet (3 m) with 1/2-inch (13-mm) rod.
- F. Install supports for vertical copper tubing every 10 feet (3 m).
- G. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 (DN 25) and Smaller: 32 inches (815 mm) with 3/8-inch (10-mm) rod.
- H. Install hangers for vertical PEX tubing every 48 inches (1200 mm).

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 0553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Inspect domestic water piping as follows:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2) Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Test domestic water piping as follows:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

- B. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- C. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new domestic water piping before using.
 - 2. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 - 3. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.

3.11 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Facility Water Distribution Piping."
- E. Under Building Slab Domestic Water Piping to Island Sinks:
 - 1. Pre-Insulated PEX Tube; fittings for PEX tube; and crimped or cold expansion joints.
- F. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
 - 1. NPS 1/4 (6.35mm) and Smaller for Dishwasher, Coffee Maker, and Refrigerator Final Connection: Soft copper tube, Type L (Type B); copper fittings; and soldered or compression joints.
 - 2. NPS 1 (DN 25) and Smaller: Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 3. NPS 1-1/4 and NPS 1-1/2 (DN 32 and DN 40): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 4. NPS 2 (DN 50): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 5. NPS 2-1/2 (DN 65): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 6. NPS 3 (DN 80): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 7. NPS 4 (DN 100): Hard copper tube, Type L (Type B); copper pressure fittings; and soldered joints.
 - 8. NPS 2 (DN 50): Hard copper tube, Type L (Type B) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 9. NPS 2-1/2 (DN 65): Hard copper tube, Type L (Type B) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 10. NPS 3 (DN 80): Hard copper tube, Type L (Type B) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 11. NPS 4 (DN 100): Hard copper tube, Type L (Type B) with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- G. At Installer's option for aboveground domestic water piping, install Type L, drawn copper tube with mechanical joint copper press fittings for pipe sizes 4 inches and smaller.
 - 1. Valves with bodies meeting requirements of Section "General Duty valves for Plumbing Piping" may be used in mechanical joint copper press systems

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

2. Throttling Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.
- C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, on each water supply to plumbing fixtures that do not have supply stops and on each water supply to plumbing fixtures that do have supply stops but where take off from main or branch is not in the same room.
- D. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- E. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
1. Install hose-end drain valves at low points in water mains, risers, and branches.
- F. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 HYPERLINK

"<http://contact.arcomnet.com/ContentContact.aspx?sect=221119&ver=09/01/17&format=FL&sid=13860>"

RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:

1. Backflow preventers.
2. Calibrated balancing valves.
3. Temperature-actuated water mixing valves.
4. Strainers.
5. Outlet boxes.
6. Hose bibbs.
7. Wall hydrants.
8. Drain valves.
9. Water hammer arresters.

- B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers and pressure gages in domestic water piping.
2. Division 22 Section "Sanitary Waste Piping Specialties" for trap seal protection device.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig(860 kPa), unless otherwise indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.
- B. Backflow preventer assembly test reports.

1.7 QUALITY ASSURANCE

- A. NSF Compliance as required by authorities having jurisdiction:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
 - 3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.
- B. Comply with NSF 372 for low lead.

2.2 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. FEBCO; SPX Valves & Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1013.
 - 3. Operation: Continuous-pressure applications.
 - 4. Pressure Loss: 12 psig(83 kPa) maximum, through middle 1/3 of flow range.
 - 5. Body: Bronze for NPS 2(DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2(DN 65) and larger.
 - 6. End Connections: Threaded for NPS 2(DN 50) and smaller; flanged for NPS 2-1/2(DN 65) and larger.
 - 7. Accessories:

- a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2(DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2(DN 65) and larger.
- b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 CALIBRATED BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett.
 - b. Armstrong International, Inc.
 - c. Tour Andersson.
2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2(DN 50).

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Apollo/Conbraco Industries, Inc.
 - b. Armstrong International, Inc.
 - c. Lawler Manufacturing Company, Inc.
 - d. Leonard Valve Company.
 - e. Powers; a Watts Industries Co.
 - f. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig(860 kPa).
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, dial thermometer, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig(860 kPa) minimum, unless otherwise indicated.
9. Valve Finish: Rough bronze.
10. Piping Finish: Copper.

B. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Controls.
 - b. Cash Acme.
 - c. Apollo/Conbraco Industries, Inc.
 - d. Honeywell Water Controls.

- e. Lawler Manufacturing Company, Inc.
 - f. Leonard Valve Company.
 - g. Powers; a Watts Industries Co.
 - h. Watts Industries, Inc.; Water Products Div.
 - i. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
 3. Pressure Rating: 125 psig(860 kPa) minimum, unless otherwise indicated.
 4. Body: Bronze or brass body with corrosion-resistant interior components.
 5. Temperature Control: Adjustable.
 6. Inlets and Outlet: Threaded with integral check valves.
 7. Finish: Rough or chrome-plated bronze.
 8. Tempered-Water Setting: 110 deg F(deg C).

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ames.
2. Apollo.
3. Watts.
4. Mueller
5. Wilkins.

B. Y-Pattern Strainers:

1. Pressure Rating: 125 psig(860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2(DN 50) and smaller; flanged for NPS 2-1/2(DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2(DN 50) and Smaller: 0.020 inch(0.51 mm).
 - b. Strainers NPS 2-1/2 to NPS 4(DN 65 to DN 100): 0.062 inch(1.57 mm).
 - c. Strainers NPS 5(DN 125) and Larger: 0.10 inch(2.54 mm).
6. Drain: Pipe plug for NPS 2(DN 50) and smaller; Factory-installed, hose-end drain valve for NPS 2-1/2(DN 65) and larger.

2.6 OUTLET BOXES

A. Ice Maker Outlet Boxes:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
3. Supply Shutoff Fittings: NPS 1/4(DN 7.5) quarter turn ball valve, chrome plated.

B. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Oatey.
 - f. Plastic Oddities; a division of Diverse Corporate Technologies.
 - g. Sioux Chief Manufacturing Company, Inc.
2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2(DN 15) gate, globe, or ball valves and NPS 1/2(DN 15) copper, water tubing.
6. Drain: NPS 2(DN 50) standpipe and P-trap for direct waste connection to drainage piping.

2.7 HOSE BIBBS

A. Anti-Siphon Wall Faucet (HB-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Woodford Manufacturing Company.
 - g. Zurn Plumbing Products Group.
2. Basis of Design: Woodford Model 24.
3. Pressure Rating: 125 psig(860 kPa).
4. Operation: Loose key.
5. Inlet: NPS 3/4 (DN 20).
6. Outlet: With vacuum breaker and 3/4" male hose thread complying with ASSE Standard 1011.
7. Seat: Standard O size washer
8. Finish: Chrome
9. With metal wheel handle

B. Anti-Siphon Hose Bibbs for Non Freezing Areas: (HB-2)

1. Manufacturers: Same as listed above for HB-1.
2. Basis of Design: Woodford Model B75.
3. Operation: Loose key
4. Supply Connections: NPS 3/4(DN 20) threaded.
5. Outlet Connection: Concealed with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig(860 kPa).
7. Box: Slim, flush mounting with lockable cover.

8. Box and cover finish: Chrome.
9. Operating Keys: One for each unit.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants (NFWH):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Woodford Manufacturing Company.
 - g. Zurn Plumbing Products Group.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig(860 kPa).
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1(DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Operating Keys: Two with each wall hydrant.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig(2760-kPa) minimum CWP.
3. Size: NPS 3/4(DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4(DN 20).
4. Body: ASTM B 62 bronze.

5. Inlet: NPS 3/4(DN 20) threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
 4. Register each backflow preventer with the local jurisdiction for ongoing testing.
- C. Install calibrated balancing valves in locations where they can easily be adjusted.
- D. Install primary temperature-actuated water mixing valves in accordance with manufacturer's requirements, and with shutoff valves on inlets and with shutoff valve on outlet.
- E. Install Y-pattern strainers for water on supply side of each inline pump and elsewhere as indicated.
- F. Install individual water tempering valves at each connection to all lavatories and sinks in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.

- A. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 1000 "Rough Carpentry."
- B. Install water hammer arresters in water piping according to PDI-WH 201.
- C. Install hose bibs with vacuum breaker on wall.
- D. Install nonfreeze wall hydrants with valve body within building, not within outside wall.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
 - 1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - 2. Test each domestic water piping specialty according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

- A. Set field-adjustable flow set points of calibrated balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

SECTION 22 1123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic water circulation:
 - 1. Close-coupled, in-line, centrifugal pumps.
- B. Terminology used in this Section is from HI 1.1-1.2 and HI 5.1-5.6.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.
- D. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CLOSE COUPLED, IN-LINE, CENTRIFUGAL PUMPS

- A. Manufacturers:
 1. Bell & Gossett.
- B. Basis of Design: Bell & Gossett Model PL.
- C. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, centrifugal pumps.
 1. Pump and Motor Assembly: Motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
 2. Casing: Bronze, with companion-flange connections.
 3. Face Plate: Stainless steel.
 4. Impeller: Corrosion-resistant material.
 5. Shaft: Carbon steel.
 6. Shaft Sleeve: Stainless steel.
 7. Seal: Mechanical, carbon on silicon carbide.
 8. Motor: Single speed, ODP, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 9. Motor Bearings: Sealed steel ball bearings, permanently lubricated.
 10. Elastomers: EPDM.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 0500 "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Manufacturers:
 - a. Honeywell International, Inc.
 - b. Square D.
 - c. White-Rodgers Div.; Emerson Electric Co.
 - 2. Type: Strap-on sensor for installation on hot-water circulation piping.
 - 3. Operation of Pump: On or off.
 - 4. Power Requirement: 120 V, ac.
 - 5. Settings: Start pump at 100 deg F(38 deg C) and stop pump at 120 deg F(49 deg C).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.
- D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support pump weight.
 - 1. Comply with requirements for vibration isolation devices specified in Section 22 0548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
 - 2. Comply with requirements for hangers and supports specified in Section 22 0529 "Hangers and Supports for Plumbing Piping and Equipment."

3.3 CONTROL INSTALLATION

- A. Install electric-type thermostats on hot-water return piping.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Connect thermostats to pumps that they control.

3.5 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 22 0553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Set thermostats for automatic starting and stopping operation of pumps.
 - 5. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 7. Start motor.
 - 8. Open discharge valve slowly.

9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.7 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 1123

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SECTION 22 1313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:
1. Cleanouts.
 2. Precast concrete manholes.

1.2 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 ACTION SUBMITTALS

- A. Shop Drawings: For the following:
1. Manholes: Include plans, elevations, sections, details, and frames and covers.
 2. Product Data: Submit pertinent data for sewer pipe and fittings, flexible couplings, cleanout caps and covers, and underground pipe markers.
 3. Materials Source: Submit source location and names of material suppliers.
 4. Manufacturer's Installation Instructions:
 - a. Indicate special procedures required to install products specified
 - b. Certify products meet or exceed specified requirements
 5. Manufacturer's Certificate: Certify products meet or exceed specified requirements

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of pipe runs, connections, manholes, and invert elevations
1. For all mains record length of pipe run, invert elevations and slope.
 2. For all laterals record:
 - a. Y+: Distance from the downstream manhole to the wye fitting.
 - b. E+: Distance measured along the lateral centerline to the lateral end.
 - c. L: Perpendicular distance from the lateral end to main.
 - d. Two witness dimensions from the cleanout to a permanent structure.
 - 1) Use manholes, catch basins, valves, hydrants, or property corners.
 - 2) Do not witness to trees or building corners.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- B. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than three days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PVC SEWER PIPE AND FITTINGS

- A. Plastic Pipe: ASTM D3034, Type PSM Poly(Vinyl Chloride) (PVC); bell and spigot style rubber ring sealed gasket joints.
 - 1. Wall Thickness:
 - a. SDR 35 for pipe buried 0-12 feet deep.
 - b. SDR 26 for pipe buried over 12 feet deep.
 - 2. Joints: ASTM D3212, joints using elastomeric seals.
 - 3. Gaskets: ASTM F477, elastomeric gaskets.
- B. Plastic Fittings: ASTM F1336, Poly(Vinyl Chloride) (PVC) gasketed sewer fittings; fabricated from SDR 26 pipe or molded.
 - 1. Joints: ASTM D3212, joints using elastomeric seals.
 - 2. Gaskets: ASTM F477, elastomeric gaskets.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
- C. Shielded, Stainless-Steel Couplings: CISPI 310, with ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
- D. Heavy-Duty, Shielded, Stainless-Steel Couplings, NPS 10 and Smaller: With ASTM A 666, Type 301 or Type 304, stainless-steel shield; 2 or more stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

2.5 ABS PIPE AND FITTINGS

- A. ABS Sewer Pipe and Fittings: ASTM D 2751, with bell-and-spigot ends for gasketed joints.
 - 1. NPS 3 to NPS 6(DN 80 to DN 150): SDR 35.
 - 2. NPS 8 to NPS 12(DN 200 to DN 300): SDR 42.
 - 3. Gaskets: ASTM F 477, elastomeric seals.

2.6 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76(ASTM C 76M), with bell-and-spigot or groove and tongue ends for gasketed joints with ASTM C 443(ASTM C 443M), rubber gaskets.
 - 1. Provide class and wall type for reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

2.7 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 - 1. For Concrete Pipes: ASTM C 443(ASTM C 443M), rubber.
 - 2. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 3. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

4. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.8 CLEANOUTS

- A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
 1. Top-Loading Classification: Heavy duty.
 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.9 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478(ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 1. Diameter: 48 inches(1200 mm) minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch(150-mm) minimum thickness for floor slab and 4-inch(100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 4-inch(100-mm) minimum thickness, and of length to provide depth indicated.
 5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Joint Sealant: ASTM C 990(ASTM C 990M), bitumen or butyl rubber.
 7. Resilient Pipe Connectors: ASTM C 923(ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Individual steps or ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch(300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches(1500 mm).
 9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
 10. Grade Rings: Reinforced-concrete rings, 6- to 12-inch total thickness, to match diameter of manhole frame and cover.

11. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

B. Manhole Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

2.10 CONCRETE

A. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

B. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: Minimum 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: Minimum 4 percent.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

- a. Shielded flexible couplings for same or minor difference OD pipes.
2. Use pressure-type pipe couplings for force-main joints.
- B. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials for each size range:
 1. NPS 3(DN 80): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints joints.
 2. NPS 3(DN 80): Hubless cast-iron soil pipe and fittings; shielded, stainless-steel couplings; and coupled joints.
 3. NPS 3(DN 80): NPS 4(DN 100) PVC sewer pipe and fittings, gaskets, and gasketed joints.
 4. NPS 4(DN 100): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 5. NPS 4(DN 100): Hubless cast-iron soil pipe and fittings; shielded, stainless-steel couplings; and coupled joints.
 6. NPS 4(DN 100): PVC sewer pipe and fittings, gaskets, and gasketed joints.
 7. NPS 5 and NPS 6(DN 125 and DN 150): Hub-and-spigot, Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 8. NPS 5 and NPS 6(DN 125 and DN 150): Hubless cast-iron soil pipe and fittings; shielded, stainless-steel couplings; and coupled joints.
 9. NPS 5 and NPS 6(DN 125 and DN 150): NPS 6(DN 150) cellular-core PVC pipe, PVC sewer pipe fittings, and solvent-cemented joints.
 10. NPS 5 and NPS 6(DN 125 and DN 150): NPS 6(DN 150) PVC sewer pipe and fittings, gaskets, and gasketed joints.
 11. NPS 8 and NPS 10(DN 200 and DN 250): Cellular-core PVC pipe, PVC sewer pipe fittings, and solvent-cemented joints.
 12. NPS 8 and NPS 10(DN 200 and DN 250): PVC sewer pipe and fittings, gaskets, and gasketed joints.
 13. NPS 12 and NPS 15(DN 300 and DN 375): PVC sewer pipe and fittings, gaskets, and gasketed joints.
 14. NPS 12 and NPS 15(DN 300 and DN 375): Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.
 15. NPS 18 to NPS 24(DN 450 to DN 600): Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or combination of both.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping below frost line.
 - 3. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 4. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 5. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install PVC cellular-core piping according to ASTM D 2321 and ASTM F 1668.
 - 7. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 8. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

- A. Basic piping joint construction is specified in Division 22 Section "Common Work Results for Plumbing" Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 - 2. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
 - 3. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 - 4. Join PVC cellular-core piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
 - 5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 - 6. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 - 7. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.

- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches(76 mm) above finished surface elsewhere, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use light-duty, top-loading classification cleanouts in unpaved foot-traffic areas.
 - 2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - 4. Use extra-heavy-duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches(450 by 450 by 300 mm) deep. Set with tops 1 inch(25 mm) above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Connect pressure, force-main piping to building's sanitary force mains specified in Division 22 Section "Sanitary Waste and Vent Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch(150-mm) overlap, with not less than 6 inches(150 mm) of concrete with 28-day compressive strength of 3000 psi(20.7 MPa).
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20(DN 100 to DN 500). Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches(150 mm) of concrete with 28-day compressive strength of 3000 psi(20.7 MPa).
 - 3. Make branch connections from side into existing piping, NPS 21(DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches(76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches(150 mm) of concrete for minimum length of 12 inches(300 mm) to provide additional support of collar from connection to undisturbed ground.

- a. Use concrete that will attain minimum 28-day compressive strength of 3000 psi(20.7 MPa), unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 CLOSING ABANDONED SANITARY SEWERAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
1. Close open ends of piping with at least 8-inch-(200-mm-) thick, brick masonry bulkheads.
 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
1. Remove manhole and close open ends of remaining piping.
 2. Remove top of manhole down to at least 36 inches(915 mm) below final grade. Fill to within 12 inches(300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.10 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches(600 mm) of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile(4.6 L/millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924(ASTM C 924M).
 - c. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
 7. Manholes: Perform hydraulic test according to ASTM C 969(ASTM C 969M).
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.
- 3.12 CLEANING
- A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION 22 1313

SECTION 22 3450 - DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Fuel-Fired Water Heaters:
 - a. Commercial, condensing storage gas water heaters.
 - b. Expansion tanks.
 - c. Water heater accessories.

1.2 SUBMITTALS

- A. Product Data:
 - 1. For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control test reports.
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters solar thermal system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. NSF Compliance as required by authorities having jurisdiction:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
3. Comply with NSF 372, "Drinking Water System Components – Lead Content"

1.6 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.7 WARRANTY

- A. Special Warranty:
 1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.
 - a. Failures include, but are not limited to, the following:
 - 1) Leaks.
 - b. Warranty Period(s): From date of Substantial Completion:
 - 1) Water Heater: Three years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS WATER HEATERS

- A. Commercial, Condensing, Storage Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.
 1. Manufacturers: Subject to compliance with requirements, provide Lochinvar "Shield" or an engineer approved equivalent product.
 - a. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.
 2. Description: Factory fired natural gas direct fired stainless steel heat exchanger mounted on top of storage tank. Manufacturer's proprietary design to provide at least 96 percent combustion efficiency at optimum operating conditions.
 3. Storage-Tank Construction: Round vertical steel with 150-psig(1035-kPa) minimum working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2(DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 4. Factory-Installed, Heater Appurtenances:
 - a. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

- b. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - c. Jacket: Steel with enameled finish.
 - d. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
 - e. Circulation Pump: All bronze.
5. Burner: Premix design, constructed of high temperature stainless steel with woven metal fiber outer covering and variable speed blower.
 6. Heat Exchanger: Natural gas direct fired stainless steel heat exchanger.
 7. Temperature Control: Adjustable thermostat.
 8. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.

2.2 EXPANSION TANKS

A. Diaphragm-Type Expansion Tanks:

1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - a. Manufacturers:
 - 1) AMTROL Inc.
 - 2) Armstrong Pumps, Inc.
 - 3) Bell and Gossett.
 - b. Construction:
 - 1) Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - 2) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - 3) Air-Charging Valve: Factory installed.
 - 4) Working-Pressure Rating: 150 psig(1035 kPa).

2.3 WATER HEATER ACCESSORIES

- A. Vacuum Relief Valves: ANSI Z21.22 rated and CSA certified with all brass body and protective cap.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- C. Combustion Air and Vent Piping: PVC or CPVC plastic vent materials in accordance with water heater manufacturers' requirements.

2.4 SOURCE QUALITY CONTROL

- A. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- B. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install gas water heaters according to NFPA 54.
- D. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- E. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- F. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.
- H. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.
- I. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- J. Fill water heaters with water.
- K. Charge diaphragm expansion tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to components to allow service and maintenance. Arrange piping for easy removal of components.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- E. Vent and Combustion-Air Connection, Condensing, Gas-Fired Water Heater: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - c. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - d. Requirements for Low-Emitting Materials:
 - 1) CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2) PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3) Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 4. Slope pipe vent back to water heater.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace system components that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain water heaters. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 3450

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing fixtures and related components.
- B. Related Sections include the following:
 - 1. Division 22 Section "Domestic Water Piping Specialties" for mixing valves and specialty fixtures not included in this Section.

1.2 DEFINITIONS

- A. Barrier-Free Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Piping and general-duty valves are included where indicated. Fittings specified in this Section include:
 - 1. Supplies and stops.
 - 2. Faucets and spouts.
 - 3. Drains and tailpieces.
 - 4. Traps and waste pipes.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Regulatory Requirements: Comply with the following:

1. Michigan Building Code (ANSI117) for plumbing fixtures for people with disabilities.
 2. Michigan Plumbing Code.
 3. Local authority having jurisdiction.
 4. Michigan and local Department of Health requirements.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Compliance as required by authorities having jurisdiction:
1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
 3. Comply with NSF 372, "Drinking Water System Components – Lead Content"
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specified requirements, provide commercial grade plumbing fixtures by one of the following:
1. Stainless Steel Sinks:
 - a. Elkay
 - b. Just
 2. Faucets:
 - a. Chicago Faucet
 - b. Zurn

2.2 SINKS

1. Provide offset tailpiece on barrier-free units.
 2. Provide thermostatic mixing valve on hot water line to all sink faucets. Mount below sink within kneeboard. Refer to Section 22 1119 for mixing valve.
 3. Provide plastic under lavatory trap and supplies insulation kit on barrier-free units. Refer to articles below.
- B. SK-1 Stainless Steel Sinks (Barrier-Free): 19.5" x 19" x 5-1/2" deep self-rimming single compartment sink, with rear center drain location; LKVR18B vandal resistant stainless steel grid strainer and 1-1/2" O.D. offset tailpiece; drilled for 8" center faucet (3 holes). Fabricate sink from 18-gauge, Type 304 stainless steel conforming to ASTM A167, lustrous satin finish and bottom only pads. Elkay Model LRAD191955 or equivalent. Provide F-1 faucet, trap, and supplies and stops as specified in the Articles below.

2.3 FAUCETS

- A. F-1 Sink Faucet: Polished chrome plated cast brass widespread with adjustable centers, quarter turn faucet with 8" center set, rigid gooseneck spout with 1.0 gpm outlet and vandal resistant color coded metal dome lever handles. Zurn Faucet Model Z831B3-XL or equivalent.

2.4 UNDER-LAVATORY GUARDS

A. Under-lavatory Shield-Type Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Truebro by IPS Corporation; Lav-Shield.
 - b. Zurn Industries, Inc.; Rigid Lavatory Enclosure – Vandal Guard.
2. Description: One piece shield for covering supply and drain piping assemblies and other underlav mounted accessories to prevent direct contact with and to provide vandal resistance. Field trim to fit tightly to lavatory and adjacent surfaces.
3. Material and Finish: Rigid, high impact, stain resistant, molded PVC plastic, white.

B. Under-Lavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Plumberex Specialty Products, Inc.
 - b. Truebro by IPS Corporation.
 - c. ProFlo
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 FITTINGS, TRIM AND ACCESSORIES

A. Fittings for Plumbing Fixtures: Fittings include the following:

1. Supply Inlets: Copper tube, size required for final connection.
2. Supply Stops: Chrome-plated brass body, angle or straight configuration with compression fittings, loose-key type; size to match inlet pipe and supply riser.
3. Supply Risers: 3/8-inch OD flexible chrome-plated brass tube with 1/2-inch IPS straight or offset, knob-end tailpiece.
4. Traps: Chrome-plated, 17 gauge tubular brass P-trap and wall bend, with slip-joint inlet, wall flange, and escutcheon; same size as fixture outlet connection.
 - a. For concealed applications within water coolers or casework, ASTM F 409 PVC one or two-piece trap and waste to wall maybe used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install counter-mounting fixtures in and attached to casework.
- C. Install fixtures level and plumb according to roughing-in drawings.
- D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- E. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- F. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- G. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- H. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- I. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."
- J. Install under-lavatory insulation kits at barrier-free lavatory and sink locations in accordance with the following:

1. Cover hot- and cold-water supply risers, stops and handles, tailpiece, trap, and wall bend. Install in accordance with manufacturer's installation instructions. Trim connectors flush so no sharp edges remain.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust mixing valve maximum temperature limit stop in accordance with manufacturers' recommendations and in compliance with the plumbing code and authority having jurisdiction.
- C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain the following:
 - 1. Faucets.
- B. Refer to Division 01 Section "Demonstration and Training."

3.9 FIXTURE ROUGH-IN SCHEDULE

- A. Line sizes indicated below are run-out sizes, reduce size as required at connection to fixture. Main lines and drops shall be installed in sizes as indicated on drawings.
 - 1. Sink:
 - a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 2 Inch.
 - d. Vent: 1-1/2 Inch.

END OF SECTION 22 4000

SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeve-seal systems.
4. Sleeves.
5. Stack-sleeve fittings.
6. Escutcheons.
7. Grout.
8. HVAC demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.2 ACTION SUBMITTALS

A. Product Data: For dielectric fittings.

1.3 QUALITY ASSURANCE

- A. Provide HVAC systems, equipment, and materials in accordance with Michigan Mechanical Code and other applicable codes and regulations, and with authorities having jurisdiction.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, handling, and up to substantial completion. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion.

1.5 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and sleeves in structural components.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.6 PROJECT COMMISSIONING

- A. Project shall have an independent commissioning authority (CxA). Contractors for this project shall meet CxA requirements and shall coordinate with and participate in commissioning activities.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall include listing/approval stamp, label, or other markings made to specified standards.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch(3.2-mm) maximum thickness unless thickness or specific material is indicated.

- a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
- b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded end connections that match piping system materials.

1. Insulating Material: Suitable for system fluid, pressure, and temperature.

B. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig(1725-kPa) minimum working pressure at 180 deg F(82 deg C) with threaded end connections.

C. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig(2070-kPa) minimum working pressure at 225 deg F(107 deg C).

D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig(2070-kPa) minimum working pressure at 225 deg F(107 deg C).

2.4 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

- 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- 2. Pressure Plates: Plastic.
- 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.5 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.6 STACK-SLEEVE FITTINGS

- A. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With polished, chrome-plated or rough-brass finish and setscrew fastener.
- C. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- D. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- E. Split-Casting Brass Type: With polished, chrome-plated or rough-brass finish and with concealed hinge and setscrew.
- F. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

2.8 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.9 MECHANICAL ROOF PENETRATIONS

- A. Roof Curbs for Duct Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, and wood nailer. Size as required to suit roof opening and ductwork. Overall minimum height shall be 12 inches above roof insulation. Provide curbs with level tops and bottoms to match roof slope. Provide galvanized steel flashing and seal water tight. Provide insulation on interior flashing surfaces exposed to building air. Pate or equivalent.
- B. Pipe Curbs for Single or Multiple Pipe Penetrations: Prefabricated heavy-gage galvanized steel or aluminum curb with mitered and welded corners, minimum 1 1/2 inch thick rigid fiberglass insulation adhered to inside walls, built-in cant and mounting flange for roof decks, wood nailer, and acrylic clad ABS plastic cover(s), PVC boot(s), and stainless steel clamps.. Size as required to suit roof opening and piping. Overall minimum height shall be 12 inches above roof insulation. Provide curbs with level tops and bottoms to match roof slope. Pate or equivalent.
- C. Pipe Curbs for Single Pipe Penetrations: All roof pipe penetrations up to 10" O.D. shall be flashed and sealed using a Pate or equivalent pipe seal, consisting of a spun aluminum base having a minimum five inch roof surface flange, a stepped polyvinyl chloride boot to be secured to the base and the pipe with adjustable stainless steel clamps as furnished.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 01 Section "Execution" and Division 02 Section "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved.
 - 1. Drawings are diagrammatic with no attempt made to show every ell, tee, transition, fitting, or appurtenance. Provide installations that are complete in every detail, compliant with all applicable codes, and as required to provide a fully functional and operational system even though every item is not specifically indicated.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

3.3 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and finished floors according to the following:
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
 - 2. Escutcheons for Existing Piping:

- a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
- b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
- c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
- d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
- e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
- f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

3.4 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
 1. Sleeves are not required for core-drilled holes.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 9200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.5 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

- B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
1. Exterior Concrete Walls Above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves, galvanized-steel wall sleeves, or galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves, galvanized-steel wall sleeve, or galvanized-steel-pipe sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6 (DN 150): Stack-sleeve fittings.
 - b. Piping NPS 6 (DN 150) and Larger: Stack-sleeve fittings.
5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

3.8 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.9 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2(DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2(DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Wet Piping Systems: Install dielectric unions, dielectric couplings, or dielectric nipple fittings to connect piping materials of dissimilar metals.

3.10 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Sequence, coordinate, and integrate installations of mechanical equipment, giving particular attention to large equipment requiring positioning prior to closing in the building.
- B. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
1. Extend grease fittings to accessible locations.
- E. Install equipment to allow right of way for piping installed at required slope.
- F. Installing contractor shall bear all additional costs, including that of Architect/Engineer redesign and that of other trades, incurred as a result of installation of other than scheduled equipment.
- G. Verify final equipment locations for roughing-in.
- H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.11 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.12 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches(100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch(450-mm) centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi(20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 section for cast-in-place concrete.

3.13 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.14 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
 1. Clean surfaces that will come into contact with grout.
 2. Provide forms as required for placement of grout.
 3. Avoid air entrapment during placement of grout.
 4. Place grout, completely filling equipment bases.
 5. Place grout on concrete bases and provide smooth bearing surface for equipment.
 6. Place grout around anchors.
 7. Cure placed grout.

3.15 MECHANICAL ROOF PENETRATIONS

- A. Install mechanical roof penetrations in accordance with roof curb manufacturer's recommendations and in strict compliance with roofing manufacturer's requirements.
 1. Roofs with Warranty: Roof penetrations and curbs shall be installed in such a manner to maintain roofing warranty.
- B. Roof Curbs for Duct Penetrations: Provide galvanized steel flashing and seal water tight. Provide insulation on interior flashing surfaces exposed to building air.
- C. Pipe Curbs for Pipe Penetrations: Secure boot to curb base and secure boot to pipe with adjustable stainless steel clamps.

3.16 INSTALLATION OF ACCESS DOORS

- A. Where lay-in ceilings are used, the access to ceiling space is provided through the removable ceiling panels. Where access is required to valves, pipes, dampers or other devices in spaces above non-removable ceilings or in chases, the Contractor requiring the access doors shall provide access doors. Access doors required in rated walls and ceiling shall bear the same rating. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
 - 1. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
 - 2. Adjust hardware and panels after installation for proper operation.

3.17 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 0500

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory.
- B. Section includes general requirements for single-phase general-purpose motors for use on ac power systems and installed at equipment manufacturer's factory.
- C. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
- D. Section includes general requirements for single-phase and polyphase, general-purpose, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed in field as a replacement.

1.2 ACTION SUBMITTALS

- A. Product Data: For each field installed shaft grounding ring.
- B. Product Data for Replacement Motors: For each type and size of motor indicated, provide nameplate data and ratings; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data for replacement motors.

1.4 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.
- B. For motors using variable frequency controller, motors to be designed for such application and suitable for use throughout speed range without overheating.
- C. Coordinate replacement motor support with requirements for driven load; access for maintenance; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

- D. Coordinate replacement motor size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet(1000 m) above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
 - 1. Provide premium efficient motors where scheduled or when used with a variable frequency controller.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Class B.
- I. Insulation: Class F.

- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Manufacturer's standard material.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 3. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 4. Shaft Grounding Ring: Factory installed Aegis Model SGR shaft grounding ring consisting of maintenance free, circumferential, bearing protection ring with conductive micro fiber shaft contacting material.
 - 5. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONIC COMMUTATION MOTOR (ECM)

- A. Description: Motor to be an electronic commutation motor (ECM) specifically designed for direct drive fan applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

3.1 EXECUTION

- A. SHAFT GROUNDING RING INSTALLATION
- B. If not factory installed, field install at each three phase motors utilizing a variable frequency controller a shaft grounding ring. Attach according to manufacturer's written instructions.

3.2 REPLACEMENT MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

3.3 FIELD QUALITY CONTROL OF REPLACEMENT MOTORS

- A. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.
 - 1. Alignment procedures are to be witnessed by Owner's representative.
- B. Testing: Perform the following field quality-control testing:
 - 1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 2. Test interlocks and control features for proper operation.
 - 3. Verify that current in each phase is within nameplate rating.
 - 4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Adjusting: Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

END OF SECTION 23 0513

SECTION 23 0519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermometers.
 - 2. Gages.
 - 3. Test plugs.

1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft.
 - 2. Marsh Bellofram.
 - 3. Miljoco Corp.
 - 4. Trerice, H. O. Co.
 - 5. Weiss Instruments, Inc.
 - 6. Weksler Instruments.

- B. Case: Metal or plastic, 9 inches(229 mm) long.
- C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.
- C. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ashcroft.
 - 2. Marsh Bellofram.
 - 3. Miljoco Corp.
 - 4. Trerice, H. O. Co.
 - 5. Weiss Instruments, Inc.
 - 6. Weksler Instruments.
 - 7. Insert manufacturer's name.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
 - 1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch(114-mm) diameter.
 - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
 - 3. Pressure Connection: Brass, NPS 1/4(DN 8), bottom-outlet type unless back-outlet type is indicated.
 - 4. Movement: Mechanical, with link to pressure element and connection to pointer with front recalibration.
 - 5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
 - 6. Pointer: Red or other dark-color metal.
 - 7. Window: Glass or plastic.
 - 8. Ring: Metal.
 - 9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure(100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4(DN 8) brass:
 - a. Ball valve for water systems.
2. Tubing: NPS 1/4(DN 8) steel or copper.
3. Snubbers: ASME B40.5, NPS 1/4(DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Co.
6. Trerice, H. O. Co.
7. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F(3450 kPa at 93 deg C).

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air or water service at minus 30 to plus 275 deg F(minus 35 to plus 136 deg C) shall be EPDM.
2. Insert material for oil, or gas service at 20 to 200 deg F(minus 7 to plus 93 deg C) shall be CR.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. Elsewhere as indicated on drawings or schematics.

3.2 GAGE APPLICATIONS

- A. Install pressure gages in the following locations:
 - 1. At heating-water inlets and outlets of boilers
 - 2. At chilled- and condenser-water inlets and outlets of chillers
 - 3. Across suction and discharge of each base mounted pump
 - 4. Elsewhere as indicated on drawings or schematics.
- B. Install dry-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.
- C. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
 - 1. Provide elbows as required to install gauges at location and angle readable from standing position on floor.
- D. Install ball valve and snubber fitting in piping for each pressure gage for fluids.
- E. Install test plugs in tees in piping.

3.4 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

3.5 ADJUSTING

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 23 0519

SECTION 23 0523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy butterfly valves.
3. Bronze check valves.
4. Gray-iron swing check valves.

B. Related Sections include the following:

1. Division 23 piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and charts.
3. Division 23 Section "Instrumentation and Control for HVAC" for control valves and actuators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves and ASME B31.1 for power piping valves.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect valve ends from damage.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2(DN 50) and smaller with threaded ends.
- C. Ferrous Valves: NPS 2-1/2(DN 65) and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 1. Lever Handle: For quarter-turn valves NPS 4(DN 100) and smaller.
 2. Handwheel: For valves other than quarter-turn types.
- G. Extended Valve Stems: Include the following on 1-1/2" and larger insulated valves in chilled water lines:
 1. 2-inch (50-mm) stem extensions.
 2. Extended operating handle of non-thermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
- H. Memory Stops: Include memory stops that are fully adjustable after insulation is applied.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: AWWA C606.
- K. Valve Solder Ends: Solder joint with sockets according to ASME B16.18.
 1. Caution: Use solder with melting point below 840 deg F(454 deg C) for angle, check, gate, and globe valves; below 421 deg F(216 deg C) for ball valves.

- L. Valve Threaded Ends: Threaded with threads according to ASME B1.20.1.
- M. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

A. Manufacturers:

- 1. Two-Piece, Copper-Alloy Ball Valves:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Jomar International, LTD.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Industries, Inc.; Water Products Div.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

- C. Two-Piece, Copper-Alloy Ball Valves: Cast bronze threaded two-piece body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig(4140-kPa) minimum CWP rating and blowout-proof stem.
- D. High Performance Ball Valves, NPS 2(DN 50) and Smaller: 600psi WOG pressure, 150 SWP, two piece bronze body, full port, stainless steel ball, replaceable "TFE" seats and seal, blowout proof stem, vinyl covered handle, and threaded ends.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

- 1. Lug Type, Ferrous-Alloy Butterfly Valves:
 - a. Apollo Valves.
 - b. Crane.
 - c. General Signal; DeZurik Unit.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Industries, Inc.; Water Products Div.

2. Grooved-End, Ductile-Iron Butterfly Valves:

- a. Milwaukee Valve Company.
- b. NIBCO INC.
- c. Victaulic Co. of America.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff.

- C. Flangeless, 200-psig(1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Lug type with one- or two-piece stainless steel stem, ASTM A 126 cast iron or ASTM A 536 ductile iron body, EPDM seat, aluminum bronze disc.
- D. Grooved-End, Minimum 200-psig(1380-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron body with grooved ends, one- or two-piece stainless steel stem, EPDM seat, aluminum bronze disc.
- E. High Performance Butterfly Valves, NPS 2-1/2(DN 65) and Larger: 150 psi WCB cast steel bodies, cast iron bodies, lug style, stainless steel disc, RTFE/stainless garter spring seats, stainless steel stem.

2.5 BRONZE CHECK VALVES

A. Manufacturers:

- 1. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. McWane, Inc.; Kennedy Valve Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

D. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.6 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

- 1. Gray-Iron Swing Check Valves:
 - a. Apollo Valves.
 - b. Crane.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Industries, Inc.; Water Products Div.

2. Grooved-End, Ductile-Iron Swing Check Valves:

- a. Victaulic Co. of America.

B. Gray-Iron Swing Check Valves, General: MSS SP-71.

C. Class 125, gray-iron, swing check valves with bronze trim and asbestos-free gasket.

- D. Class 250, gray-iron, swing check valves bronze trim and asbestos-free gasket.
- E. 300-psig(2070-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved ends, EDPM seals, and ductile iron or stainless steel disc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. For Water Systems:
 - a. Shutoff Service: Ball or butterfly valves.
 - b. Throttling Service: Ball or butterfly valves.
 - c. Balancing Valve Service: Throttling valve with memory stop.
- B. Select valves, except lug types, with the following end connections:
 - 1. For Copper Tubing, NPS 2(DN 50) and Smaller: Threaded ends.
 - 2. For Steel Piping, NPS 2(DN 50) and Smaller: Threaded ends.
 - 3. For Steel Piping, NPS 2-1/2 to NPS 4(DN 65 to DN 100): Flanged ends.
 - 4. For Steel Piping, NPS 5(DN 125) and Larger: Flanged ends.
 - 5. For Grooved-End, Steel Piping: Valve ends may be grooved.
- C. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- D. Hydronic Water Piping: For hot water heating and chilled water piping systems, use the following types of valves:

1. Ball Valves, NPS 2(DN 50) and Smaller: Two-piece, 600-psig(4140-kPa) CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2(DN 65) and Larger: Lug type, 200-psig(1380-kPa) CWP rating, ferrous alloy, with aluminum bronze disc and EPDM rubber seat and seals.
3. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2(DN 65) and Larger: Minimum 200-psig(1380-kPa) CWP Rating, with aluminum bronze disc and EPDM rubber seat and seals..
4. Swing Check Valves, NPS 2(DN 50) and Smaller: Type 4, Class 125 or 150, bronze.
5. Swing Check Valves, NPS 2-1/2(DN 65) and Larger: Class 125, gray iron.
6. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2(DN 65) and Larger: 300-psig(2070-kPa) CWP rating.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Common Work Results for HVAC" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 0523

SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
1. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Metal framing systems.
 4. Thermal-hanger shield inserts.
 5. Fastener systems.
 6. Pipe stands.
 7. Equipment supports.
- B. Related Sections include the following:
1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design supports for multiple pipes[, including pipe stands,] capable of supporting combined weight of supported systems, system contents, and test water.
 3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Fiberglass strut systems. Include Product Data for components.
4. Pipe stands. Include Product Data for components.
5. Equipment supports.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to [AWS D1.1, "Structural Welding Code--Steel."] [AWS D1.3, "Structural Welding Code--Sheet Steel."] [AWS D1.4, "Structural Welding Code--Reinforcing Steel."] [ASME Boiler and Pressure Vessel Code: Section IX.]

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from

structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4.
3. Channels: Continuous slotted steel channel with inturned lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: Plastic unit with top configuration to support pipe for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 1. Base: Plastic or stainless steel.
 2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 1. Bases: One or more plastic.
 2. Vertical Members: Two or more protective-coated-steel channels.
 3. Horizontal Member: Protective-coated-steel channel.
 4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi(34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30(DN 15 to DN 750).
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F(49 to 232 deg C) pipes, NPS 4 to NPS 16(DN 100 to DN 400), requiring up to 4 inches(100 mm) of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24(DN 20 to DN 600), requiring clamp flexibility and up to 4 inches(100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24(DN 15 to DN 600), if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4(DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8(DN 20 to DN 200).
 - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8(DN 15 to DN 200).
 - 8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2(DN 15 to DN 50).
 - 9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8(DN 10 to DN 200).
 - 10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3(DN 10 to DN 80).
 - 11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30(DN 15 to DN 750).
 - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 13. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36(DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
 - 14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36(DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 15. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36(DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 - 16. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30(DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 - 17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24(DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - 18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30(DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20(DN 20 to DN 500).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20(DN 20 to DN 500), if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches(150 mm) for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F(49 to 232 deg C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F(49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 5. C-Clamps (MSS Type 23): For structural shapes.
 6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 9. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 10. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 11. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb(340 kg).
 - b. Medium (MSS Type 32): 1500 lb(680 kg).
 - c. Heavy (MSS Type 33): 3000 lb(1360 kg).
 12. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 13. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 14. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
1. Use powder-actuated fasteners only in concrete construction that is suitable for their installation.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches(100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- H. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2(DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4(DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4(DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2(DN 8 to DN 90): 12 inches(305 mm) long and 0.048 inch(1.22 mm) thick.
 - b. NPS 4(DN 100): 12 inches(305 mm) long and 0.06 inch(1.52 mm) thick.
 - c. NPS 5 and NPS 6(DN 125 and DN 150): 18 inches(457 mm) long and 0.06 inch(1.52 mm) thick.
 - d. NPS 8 to NPS 14(DN 200 to DN 350): 24 inches(610 mm) long and 0.075 inch(1.91 mm) thick.
 - 5. Insert Material: Length at least as long as protective shield.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches(40 mm) maximum.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils(0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 0529

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SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Pipe labels.
 - 3. Stencils.
 - 4. Valve tags.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system.

1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 "Pipe Labeling Guide" for color scheme, length of field and letter height.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch(1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F(71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch(64 by 19 mm).
 - a. Size of label shall be proportional to equipment size.
6. Minimum Letter Size: 1/4 inch(6.4 mm) for name of units if viewing distance is less than 24 inches(600 mm), 1/2 inch(13 mm) for viewing distances up to 72 inches(1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic label including flow arrow formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic label with contact-type, permanent-adhesive backing. Include wrap around flow arrow tape with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: At least 1-1/2 inches(38 mm) high.

2.3 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches(32 mm) for ducts; and minimum letter height of 3/4 inch(19 mm) for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil Material: Fiberboard or metal.
 2. Stencil Paint: Exterior, gloss, black enamel unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch(6.4-mm) letters for piping system abbreviation and 1/2-inch(13-mm) numbers.
 - 1. Tag Material: Brass, 0.032-inch(0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch(A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Provide glass front frame for each valve schedule for mounting in building mechanical room.
 - 2. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Pipe Label Applications: Install pipe labels as follows:
 - 1. Use pretensioned pipe labels or self-adhesive pipe labels.
 - 2. For 10 inches (250 mm) and smaller outside diameter including insulation, use pretensioned pipe labels.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is concealed above ceilings or exposed in unfinished mechanical rooms; accessible maintenance spaces such as shafts, tunnels, and plenums as follows:
 - 1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet(15 m) along each run.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; equipment shutoff valves; convenience and hose connections; and HVAC terminal devices and similar roughing-in connections of end-use units. List tagged valves in a valve schedule.
- B. Install glass front frame valve schedule in building mechanical room. Locate at Owners representative approved location.

END OF SECTION 23 0553

SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems.
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
2. Balancing Hydronic Piping Systems.
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.3 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days advance notice of scheduled meeting time and location.
 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB Reports: Submit four copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- G. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
 - 2. TAB Technician: Employee of the TAB specialist and certified by NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 FIELD CONDITIONS

- A. Owner Occupancy: Owner will occupy the site and existing building during TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following:
 - 1. Subject to compliance with requirements, provide the services of one of the following:
 - a. International Test and Balancing, Inc.
 - b. Quality Air Service, Inc.
 - c. Control Solutions.
 - d. Mechanical Testing Services, Inc.
 - e. Great Lakes Balancing.
 - f. Third Coast Testing and Balancing.
 - g. Integrity Test and Balance, Inc
 - h. Other local contractors may bid. Approval will be determined by project team.

3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- D. Examine the approved submittals for HVAC systems and equipment.
- E. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that equipment with functioning controls is ready for operation.
- J. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- M. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine system pumps to ensure absence of entrained air in the suction piping.
- P. Examine operating safety interlocks and controls on HVAC equipment.
- Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.
- 3.3 PREPARATION
- A. Prepare a TAB plan that includes the following:
1. Equipment and systems to be tested.
 2. Strategies and step-by-step procedures for balancing the systems.
 3. Instrumentation to be used.
 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
1. Airside:

- a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
- b. Duct systems are complete with terminals installed.
- c. Volume, smoke, and fire dampers are open and functional.
- d. Clean filters are installed.
- e. Fans are operating, free of vibration, and rotating in correct direction.
- f. Variable-frequency controllers' startup is complete and safeties are verified.
- g. Automatic temperature-control systems are operational.
- h. Ceilings are installed.
- i. Windows and doors are installed.
- j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

- a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
- b. Piping is complete with terminals installed.
- c. Water treatment is complete.
- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning per the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"; ASHRAE 111; NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"; SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing"; and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 3300 "Air Duct Accessories."
 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 0713 "Duct Insulation," Section 23 0716 "HVAC Equipment Insulation," and Section 23 0719 "HVAC Piping Insulation."

- D. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- E. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 3113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.
- 3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS
- A. Single Zone Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
 2. Set air inlets, air outlets, and supply fan at full-airflow condition.

3. Adjust air outlets to indicated airflow.
 4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan and verify operation of the static-pressure controller.
 6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
 7. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
- B. Adjust the variable-air-volume systems as follows:
1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
 2. Verify that the system is under static pressure control.
 3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
 - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
 5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

- b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
- a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:
- a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 1. Check liquid level in expansion tank.

2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
- G. Verify that memory stops have been set.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 - 2. Adjust flow-measuring devices installed in mains and branches to design water flows.

- a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

- b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
 9. Prior to verifying final system conditions, determine system differential-pressure set point.
 10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 11. Mark final settings and verify that memory stops have been set.
 12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.

- b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
- c. Mark final settings.

13. Verify that memory stops have been set.

3.11 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.12 PROCEDURES FOR BOILERS

A. Hydronic Boilers:

1. Measure and record entering- and leaving-water temperatures.
2. Measure and record water flow.
3. Record relief valve pressure setting.

3.13 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:

1. Dry-bulb temperature of entering and leaving air.
2. Airflow.
3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.14 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Prior to demolition of air and water HVAC distributions systems and equipment, measure and record existing air and water flow conditions for all equipment, ductwork and hydronic piping systems serving area being modified during the project.

1. Measure and record the operating speeds and flow rates of existing equipment.
2. Measure and record the flow rates at interconnection points between existing and new work.
3. Measure motor voltage and amperage of effected equipment. Compare the values to motor nameplate information.
4. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. After revisions are complete, measure all the HVAC air and water systems modified and restore the systems to their original or scheduled capacities.

1. Compare the indicated flow rates of the renovated work to the measured flow rates and determine the new equipment flow rates.
2. Verify that the indicated flows of the renovated work result in conditions that are within the acceptable limits defined by equipment manufacturer.
3. Re-measure, record and verify the flow rates at interconnection points between existing and new work.
4. If calculations increase or decrease the flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
5. Balance each affect branch and main.

3.15 TOLERANCES

A. Set HVAC system's flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.16 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.17 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Equipment operating curves.
 2. Pump curves.
 3. Fan curves.
 4. Manufacturers' test data.
 5. Field test reports prepared by system and equipment installers.
 6. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Engineer's name and address.
 6. Contractor's name and address.
 7. Report date.
 8. Signature of TAB supervisor who certifies the report.
 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 10. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Data for terminal units, including manufacturer's name, type, size, and fittings.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans and pump performance forms including the following:

- a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Water flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches (mm), and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 - l. Variable frequency drive information.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.

- d. Discharge static pressure in inches wg (Pa).
- e. Filter static-pressure differential in inches wg (Pa).
- f. Preheat-coil static-pressure differential in inches wg (Pa).
- g. Cooling-coil static-pressure differential in inches wg (Pa).
- h. Heating-coil static-pressure differential in inches wg (Pa).
- i. Outdoor airflow in cfm (L/s).
- j. Return airflow in cfm (L/s).
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Variable frequency drive information.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch (mm) o.c.
- f. Make and model number.
- g. Face area in sq. ft. (sq. m).
- h. Tube size in NPS (DN).
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm (L/s).
- b. Average face velocity in fpm (m/s).
- c. Air pressure drop in inches wg (Pa).
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
- e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
- f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
- g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
- h. Water flow rate in gpm (L/s).
- i. Water pressure differential in feet of head or psig (kPa).
- j. Entering-water temperature in deg F (deg C).
- k. Leaving-water temperature in deg F (deg C).
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig (kPa).
- n. Refrigerant suction temperature in deg F (deg C).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.

- e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches (mm), and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches (mm), and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm (L/s).
 - b. Total system static pressure in inches wg (Pa).
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg (Pa).
 - e. Suction static pressure in inches wg (Pa).
 - f. Variable frequency drive setpoint.
- H. Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F (deg C).
 - d. Duct static pressure in inches wg (Pa).
 - e. Duct size in inches (mm).
 - f. Duct area in sq. ft. (sq. m).
 - g. Indicated airflow rate in cfm (L/s).
 - h. Indicated velocity in fpm (m/s).
 - i. Actual airflow rate in cfm (L/s).
 - j. Actual average velocity in fpm (m/s).
 - k. Barometric pressure in psig (Pa).
- I. Air-Terminal-Device Reports:
 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.

- g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft. (sq. m).
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Air velocity in fpm (m/s).
 - c. Preliminary airflow rate as needed in cfm (L/s).
 - d. Preliminary velocity as needed in fpm (m/s).
 - e. Final airflow rate in cfm (L/s).
 - f. Final velocity in fpm (m/s).
 - g. Space temperature in deg F (deg C).
- J. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
 - 1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 - 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm (L/s).
 - b. Entering-water temperature in deg F (deg C).
 - c. Leaving-water temperature in deg F (deg C).
 - d. Water pressure drop in feet of head or psig (kPa).
 - e. Entering-air temperature in deg F (deg C).
 - f. Leaving-air temperature in deg F (deg C).
- K. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm (L/s).
 - g. Water pressure differential in feet of head or psig (kPa).
 - h. Required net positive suction head in feet of head or psig (kPa).
 - i. Pump rpm.
 - j. Impeller diameter in inches (mm).
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.

- n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
 - q. Variable frequency drive information.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig (kPa).
 - b. Pump shutoff pressure in feet of head or psig (kPa).
 - c. Actual impeller size in inches (mm).
 - d. Full-open flow rate in gpm (L/s).
 - e. Full-open pressure in feet of head or psig (kPa).
 - f. Final discharge pressure in feet of head or psig (kPa).
 - g. Final suction pressure in feet of head or psig (kPa).
 - h. Final total pressure in feet of head or psig (kPa).
 - i. Final water flow rate in gpm (L/s).
 - j. Voltage at each connection.
 - k. Amperage for each phase.
 - l. Variable frequency drive setpoint.
- L. Boiler Test Reports:
1. Unit Data:
- a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and type.
 - e. Model and serial numbers.
 - f. Fuel type and input in Btuh(kW).
 - g. Number of passes.
 - h. Ignition type.
 - i. Burner-control types.
 - j. Voltage at each connection.
 - k. Amperage for each phase.
2. Test Data (Indicated and Actual Values):
- a. Operating pressure in psig(kPa).
 - b. Operating temperature in deg F(deg C).
 - c. Entering-water temperature in deg F(deg C).
 - d. Leaving-water temperature in deg F(deg C).
 - e. Number of safety valves and sizes in NPS(DN).
 - f. Safety valve settings in psig(kPa).
 - g. High-limit setting in psig(kPa).
 - h. Operating-control setting.
 - i. High-fire set point.
 - j. Low-fire set point.
 - k. Voltage at each connection.
 - l. Amperage for each phase.
 - m. Draft fan voltage at each connection.

- n. Draft fan amperage for each phase.
- o. Manifold pressure in psig(kPa).

M. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.18 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Engineer and commissioning authority.
- B. Engineer and commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

END OF SECTION 23 0593

SECTION 23 0700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulation materials for HVAC systems.
- B. Related Sections:
 - 1. Division 22 Section "Plumbing Insulation."
 - 2. Division 23 Section "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated below:
 - 1. Mineral fiber.
 - 2. Flexible elastomeric.
 - 3. Field installed jackets

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application.
 - 1. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article
 - 1. Provide ASJ or FSK for ductwork applications, as scheduled.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Type I, 850 deg F(454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. Mineral-Fiber, Pipe, Duct and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft.(40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F(55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F(0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Provide ASJ for equipment applications.
 - 2. Provide ASJ or FSK for ductwork applications, as scheduled.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm(0.009 metric perm) at 43-mil(1.09-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F(Minus 29 to plus 82 deg C).
 - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Water-Vapor Permeance: ASTM F 1249, 3 perms(2 metric perms) at 0.0625-inch(1.6-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 200 deg F(Minus 29 to plus 93 deg C).
 - 3. Solids Content: 63 percent by volume and 73 percent by weight.
 - 4. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F(Minus 73 to plus 149 deg C).
 - 4. Color: White or gray.

5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK Jacket Flashing Sealants:

1. Products:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.
5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, and mechanical joints.

- C. Aluminum Jacket: Comply with ASTM B 209(ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
1. Factory cut and rolled to size or sheet and roll stock ready for shop or field sizing.
 2. Finish and thickness are indicated in field-applied jacket schedules.
 3. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - c. Tee covers.
 - d. Flange and union covers.
 - e. End caps.
 - f. Beveled collars.
 - g. Valve covers.
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- D. Self-Adhesive Outdoor Jacket: Minimum 40-mil-(1.0-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.
1. Coordinate color with Architect and Owner.
 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard; Alumaguard.
 - b. MFM Building Products; Flex Clad 400

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches(75 mm).
 2. Thickness: 11.5 mils(0.29 mm).
 3. Adhesion: 90 ounces force/inch(1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch(7.2 N/mm) in width.
 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches(75 mm).
 2. Thickness: 6.5 mils(0.16 mm).
 3. Adhesion: 90 ounces force/inch(1.0 N/mm) in width.
 4. Elongation: 2 percent.
 5. Tensile Strength: 40 lbf/inch(7.2 N/mm) in width.
 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Width: 2 inches(50 mm).
 2. Thickness: 6 mils(0.15 mm).
 3. Adhesion: 64 ounces force/inch(0.7 N/mm) in width.
 4. Elongation: 500 percent.
 5. Tensile Strength: 18 lbf/inch(3.3 N/mm) in width.

- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches(50 mm).
 - 2. Thickness: 3.7 mils(0.093 mm).
 - 3. Adhesion: 100 ounces force/inch(1.1 N/mm) in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch(6.2 N/mm) in width.

2.9 SECUREMENTS

- A. Aluminum Bands: ASTM B 209(ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch(0.51 mm) thick, 1/2 inch(13 mm) or 3/4 inch(19 mm) wide with wing or closed seal.
- B. Insulation Pins and Hangers:
 - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch(0.76 mm) thick by 2 inches(50 mm) square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, nylon sheet, 0.030 inch(0.76 mm) thick by 1-1/2 inches(38 mm) in diameter.
 - b. Spindle: Nylon, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches(63 mm).
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch(0.76 mm) thick by 2 inches(50 mm) square.
 - b. Spindle: Copper- or zinc-coated, low carbon steel, aluminum, or stainless steel; fully annealed, 0.106-inch-(2.6-mm-) diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive-backed base with a peel-off protective cover.
 - 4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches(38 mm) in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - 5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-(0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches(38 mm) in diameter.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-(19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.062-inch(1.6-mm) soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-(75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches(100 mm) o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches(38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches(50 mm) o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches(100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations:
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation at roof structure and seal with joint sealant.
 3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 4. Extend jacket of outdoor insulation outside roof flashing at least 2 inches(50 mm) below top of roof flashing.

5. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant.
 3. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 4. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches(50 mm).
 5. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches(50 mm).
1. Comply with requirements in Division 07 Section "Penetration Firestopping" and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches(50 mm).
 2. Pipe: Install insulation continuously through floor penetrations.
 3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

- c. On tanks and vessels, maximum anchor-pin spacing is 3 inches(75 mm) from insulation end joints, and 16 inches(400 mm) o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches(150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches(300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches(1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
 7. Stagger joints between insulation layers at least 3 inches(75 mm).
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch(150-mm) centers, starting at corners. Install 3/8-inch-(10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
 2. Fabricate boxes from galvanized steel or aluminum, at least 0.050 inch(1.3 mm) thick.
 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For mineral fiber insulation, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Insulation Installation on Control Valves:
1. Omit insulation over control valves.
- 3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION
- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
1. Flexible elastomeric pipe insulation only allowed in concealed or mechanical room locations.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches(150 mm) o.c.
 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch(25 mm), and seal joints with flashing sealant. Cover open ends of insulation and seal.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.
- E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches(450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches(75 mm) maximum from insulation end joints, and 16 inches(400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches(450 mm), place pins 16 inches(400 mm) o.c. each way, and 3 inches(75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches(50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch(13-mm) outward-clinching staples, 1 inch(25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F(10 deg C) at 18-foot(5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches(75 mm).
 5. Overlap unfaced blankets a minimum of 2 inches(50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches(450 mm) o.c.
 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, trapeze hanger bars, and duct flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches(150 mm) o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches(450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches(75 mm) maximum from insulation end joints, and 16 inches(400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches(450 mm), space pins 16 inches(400 mm) o.c. each way, and 3 inches(75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches(50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch(13-mm) outward-clinching staples, 1 inch(25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F(10 deg C) at 18-foot(5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches(75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, trapeze hanger bars, and duct flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches(150 mm) o.c.

3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC fitting jackets are indicated, install with 1-inch(25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
 2. Fill inside of fitting jackets to prevent collapse of jacket.

3.10 FINISHES

- A. Paintable Jacket Material: Paint jacket with paint system identified in Division 09 painting Sections.

3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation: Insulate the following in accordance with insulation schedule:
1. Supply air.
 2. Outdoor air.

3. Return air.
- B. Items Not Insulated:
1. Factory-insulated flexible ducts.
 2. Factory-insulated plenums and casings, except as indicated.
 3. Flexible connectors.
 4. Vibration-control devices.
 5. Factory-insulated access panels and doors.
 6. Exposed supply and return metal ducts within rooms they are serving except mechanical rooms.
 7. Exposed supply metal ducts within rooms they are serving down stream of fan coils and VAV terminal units except mechanical rooms.
 8. Volume control balancing damper lever handles.
- C. Definitions:
1. Concealed: Above solid ceiling and not visible from below.
 2. Exposed: In rooms with no ceilings or with partial ceilings (i.e. "cloud type ceilings") and visible from below.
 3. Finished Spaces: Spaces with room finishes accessible by building occupants.
 4. Unfinished Spaces: Spaces with no or limited room finishes accessible by building maintenance and support staff only.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed outside, supply and return air duct and plenum insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches(38 mm) thick and 0.75-lb/cu. ft.(12-kg/cu. m) nominal density.

3.13 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable insulation materials and thicknesses are identified for each piping system and pipe size range.
1. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Control valve stem and actuator.

3.14 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F(16 Deg C):
1. All Pipe Sizes Exposed in Mechanical Rooms and Concealed Locations: Insulation shall be one of the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.
 - b. Flexible Elastomeric: 1 inch(25 mm) thick.
 2. All Pipe Sizes Exposed in Finished Spaces: Insulation shall be following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch(25 mm) thick.
- B. Chilled Water / Heating-Hot-Water Supply and Return, 200 Deg F(93 Deg C) and below: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe, Type I: 1.5 inches thick for NPS 1-1/4" diameter and under and 2 inches thick for NPS 1-1/2" diameter and above.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 1. If more than one material is listed, selection from materials listed is Contractor's option.
- B. Pipe Fittings with Mineral Fiber Insulation:
 1. PVC Fitting Covers: 20 mils(0.6 mm) thick, white.
- C. Exposed Vertical Piping within 8 feet(2.4 m) of Floor shall be one of the following:
 1. PVC: 30 mils(0.8 mm) thick, white.
 2. Aluminum, Smooth or Stucco Embossed: 0.024 inch(0.61 mm) thick.

END OF SECTION 23 0700

SECTION 23 0900 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Work shall include furnishing all labor, materials, equipment, and service necessary for a complete and operating Building Management System (BMS), utilizing direct digital controls. The BMS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet. This shall include HVAC control, all trending, reporting and maintenance management functions related to normal building operations all as indicated.
 - 1. All labor, material, equipment and software not specifically referred to herein or on the plans, required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
- B. New work shall communicate with and be integrated into Owner's existing Johnson Controls Metasys system. Existing system is serviced by and new work shall be performed by Johnson Controls. See section below for installers.
- C. Work shall include but not limited to providing controls and instrumentation in accordance with equipment sequence of operations and their point lists. Point lists shall be a guide to the points required for control system. Final points required shall be determined by sequence of operation requirements.
- D. Work required in this section shall include providing all control components, control wiring, and services required for the connection and operation of the horizontal unit ventilators as indicated on drawings and control drawings. These new unit ventilators are replacing existing unit ventilators. The equipment controllers for each existing unit were replaced a few years back. The intent is to re-use these existing equipment controllers on the new units.
- E. Work required in this section shall include providing all control components, control wiring, and services required for the connection and operation of the chilled water/heating hot water system pumps including related variable frequency drives and piping system differential pressure sensors as indicated on drawings and control drawings.
- F. Work required in this section shall include providing all control components, control wiring, and services required for the connection, operation and monitoring of the new domestic water heater and recirculation pump.
- G. Work required in this section shall include providing all control components, control wiring, and services required for replacing the existing system electronic change over valve. With the new valve maintain the existing sequence of operation.
- H. The owner is in the process of replacing the existing 70.0 ton Trane air cooled chiller. The new 70.0 ton Trane air cooled chiller will be installed by the owner next year. During chiller operation the minimum flow through the chiller cannot fall below 80.0 GPM. In the cooling mode the primary system pump variable frequency controller must maintain a system flow above 80.0 GPM.

- I. Work required in this section shall include the complete Building Control System including all controllers, control devices, control panels, controller programming, controller programming software, controller input/output wiring, power wiring, interlock and safety wiring, graphical user interface, Graphical User Interface (GUI), Graphical Development Tool (GDT), Network Area Controller(s) (NAC), server software, controller software and programming of the NAC and server, development of all graphical screens, setup of schedules, logs and alarms, global server software control applications, system integration and coordination of the NAC and server software to the Wide Area Network.
- J. Ethernet LAN wiring, and Ethernet routing devices if applicable. The BMS shall provide a single point Ethernet connection utilizing OBIX TCP/IP to the Owner's WAN.
- K. Work required in this section shall include providing all electrical work required for this section. The system shall include all interconnecting wiring and conduit as required for a fully operational system as specified. Wiring shall be installed as per local codes or Division 26 whichever is more stringent.
 1. Power supply wiring and conduit from power source to power connection on DDC controls and DDC control panels.
 - a. Line voltage wiring shall utilize methods and materials complying with the requirements of the Electrical Specifications, local building code, and NEC.
 2. Control wiring and conduit between field-installed controls, indicating devices, and control panels.
 - a. Low voltage wiring shall use methods and materials complying with the requirements of the Electrical Specifications, local building code and NEC. Plenum rated cable is acceptable where concealed and accessible.
- L. Related Work Specified Elsewhere:
 1. Products Supplied But Not Installed Under This Section:
 - a. Control valves.
 - b. Flow switches.
 - c. Wells, sockets and other inline hardware for water sensors (temperature, pressure, flow).
 - d. Automatic control dampers, where not supplied with equipment.
 - e. Terminal unit controllers and actuators, when installed by terminal unit manufacturer.
 - f. Variable frequency drives. (This does not include VFDs integral to machinery such as chillers or boilers).
 2. Products Not Furnished or Installed But Integrated with the Work of This Section:
 - a. Chiller control systems.
 - b. Boiler control systems.
 3. Work Required Under Other Divisions Related to This Section:
 - a. Power wiring to line side of motor starters, disconnects or variable frequency drives.
 - b. Provision and wiring of smoke detectors and other devices relating to fire alarm system.
 - c. Campus LAN (Ethernet) connection adjacent to JACE network management controller.

1.2 SYSTEM DESCRIPTION

- A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described

herein. Project control drawings are diagrammatic only and any control device not shown, such as relays, accessories, etc., but required to make the system operative shall be provided.

1. The intent is to add to and expand on the existing Johnson Controls Metasys system.
 2. System architecture shall provide secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
 3. The BMS server shall host all graphic files for the control system. All graphics and navigation schemes for this project shall match those that are on the existing Framework server.
 4. A laptop computer including engineering/programming software to modify Operating System Server BMS programs and graphics shall be included.
 5. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
- B. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
 2. FCC, Part 15, Subpart B, Class B
 3. FCC, Part 15, Subpart C
 4. FCC, Part 15, Subpart J, Class A Computing Devices.
 5. UL 504 - Industrial Control Equipment.
 6. UL 506 - Specialty Transformers.
 7. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.
 8. UL 916 - Energy Management Systems All.
 9. UL 1449 - Transient Voltage Suppression.
 10. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
 11. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
 12. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
 13. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
 14. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - a. NEMA 250 - Enclosures for Electrical Equipment.
 15. NEMA ICS 1 - Industrial Controls and Systems.
 16. NEMA ST 1 - Specialty Transformers.
 17. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.
 18. CE 61326
 19. C-Tick
 20. cUL

1.3 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:

1. Division 23 Section "Common Work Results for HVAC."
2. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1. Actuator: Control device that opens or closes valve or damper in response to control signal.
2. AI: Analog Input.
3. AO: Analog Output.
4. Analog: Continuously variable state over stated range of values.
5. A-E: Architect/Engineer
6. BMS: Building Management System.
7. DDC: Direct Digital Control.
8. Discrete: Binary or digital state.
9. DI: Discrete Input.
10. DO: Discrete Output.
11. FC: Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
12. FO: Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
13. GUI: Graphical User Interface.
14. HVAC: Heating, Ventilating and Air Conditioning.
15. IDC: Interoperable Digital Controller.
16. ILC: Interoperable Lon Controller.
17. LAN: Local Area Network.
18. Modulating: Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
19. Motorized: Control device with actuator.
20. NAC: Network Area Controller.
21. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
22. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
23. OSS: Operating System Server, host for system graphics, alarms, trends, etc.
24. Operator: Same as actuator.
25. PC: Personal Computer.
26. Peer-to-Peer: Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network.
27. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.

28. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
29. PICS: BACnet Product Interoperability Compliance Statement.
30. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
31. Point: Analog or discrete instrument with addressable database value.
32. TOD: Time Of Day.
33. WAN: Wide Area Network.

1.5 WORK BY OTHERS

- A. Setting in place of valves, water pressure and differential taps, thermal wells, dampers, airflow stations, and access doors.
- B. Duct smoke detectors provide under Division 28.

1.6 ACTION SUBMITTALS

- A. Refer to Division 1 for submittal administrative requirements and procedures.
- B. Submittal shall consist of:
 1. System architecture showing all digital devices, computers and network configuration.
 2. Equipment lists of all proposed devices and equipment including data sheets of all products. Provide a PIC statement for each BACnet device and interoperability certification for each LonMark field device provided.
 3. Valve, damper, and well and tap schedules showing size, configuration, capacity and location of all equipment.
 4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480 character alarm message. All text shall be approved prior to data entry.
 5. Schematic device wiring and piping interconnection diagrams including panel and device power and sources.
 6. Software design data including flowchart of a typical DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
 7. A complete written Sequence of Operation in suppliers own terminology.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance data for control systems equipment to include in the operation and maintenance manual specified in Division 1. Include the following:
 1. Maintenance instructions and spare parts lists for each type of control device.
 2. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

3. Calibration records and list of set points.

- B. Project Record Documents: Upon completion of the work, provide a complete set of 'as-built' drawings and application software on USB drive media or compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Three copies of the 'as-built' drawings shall be provided in addition to the documents on USB drive media or compact disk.

1.8 CODES AND APPROVALS

- A. The complete BMS installation shall be in strict compliance to the national, state and local mechanical and electrical codes and the electrical section of these specifications. All devices shall be UL or FM listed and labeled for the specific use, application and environment to which they are applied.
- B. The system shall comply with NFPA 90A Air Conditioning and 90B Warm Air Heating, Air conditioning.
- C. All electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

1.9 WARRANTY

- A. All components, system software, and parts supplied by the BMS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BMS contractor at no charge shall furnish labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the Owners request for warranty service within 48 hours during normal business hours.
- B. Warranty Access
1. The Owner shall grant to the controls installer reasonable access to the BMS during the warranty period.

1.10 BMS CONTRACTOR QUALIFICATIONS

- A. The BMS contractor shall have a local office within a 50 mile(80 Km) radius of the job site, staffed with factory trained engineers fully capable of providing instruction, routine maintenance and 24-hour emergency service on all system components. The BMS contractor shall have a three year experience record in the design and installation of computerized building systems similar in scope and performance to that specified herein, and shall be prepared to provide evidence of this history as condition of acceptance and approval during Submittal.

1.11 SOFTWARE LICENSE AGREEMENT

- A. Software licensing for the NAC and server software shall give the Owner the capability to control their system and determine which contractors can bid and engineer their system.
- B. It shall be possible to insure the Owner can prevent unauthorized partners from accessing the system for engineering changes.

- C. Software licensing shall have the freedom to individually manage authorized parties and independent parties.
- D. The software licensing shall have no restrictions on which brand of NAC, server software or System Programming tools can interact with the system. Station Compatibility IN and Station Compatibility OUT must = ALL and Tool Compatibility must = ALL.
- E. The Owner shall accept the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.12 ADDED POINT AND MEMORY CAPACITY

- A. The BMS software/firmware provided shall have the capacity for an unlimited number of NACs. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.
- B. Total system point capacity shall have the capacity for an unlimited number of future points. Systems requiring future upgrades to accomplish this are not acceptable; capacity shall be provided at the time of bid.
- C. Supervising software shall allow unlimited expansion. Supervising software that is limited to the number of network area controllers is not acceptable

1.13 TESTING AND BALANCING

- A. If proper sequencing or system functions cannot be achieved with the controls, as installed, and additional controls are required, the required additional controls shall be added at the expense of the Controls provider.

1.14 DELIVERY, STORAGE, AND PROTECTION

- A. Store equipment and materials inside and protected from weather.

1.15 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Fully programmable controllers.
 - 1. JCI Metasys to match the existing system.

2.2 INSTALLERS

- A. Subject to compliance with requirements, provide products and services by the following:
 - 1. Johnson Controls (Basis of Design)
 - 2. Other contractors may bid as a voluntary alternate. Per bid the contractor shall adhere to the products and specifications as described in this section.

2.3 GENERAL

- A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, Network Area Controllers, server software server, graphical user interface software, Web Browser Clients, operator work stations, network devices and other devices as specified herein.
- B. Provide the capability to open all control valves in each individual system at one time (I.E. zone, riser) to facilitate water balancing.

2.4 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The requirement of this specification is to provide a Johnson Controls peer-to-peer networked, stand-alone, distributed control system with the capability to integrate other communication protocols in one open, interoperable system.
- B. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- C. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS. Secure Socket Layer (SSL) encryption shall be an available option for remote access.
- D. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.
- E. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.

- F. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
 - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
 - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.5 NETWORK AREA CONTROLLER (NAC)

- A. The controls Installer shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices.
- B. The Network Area Controller (NAC) shall provide the interface between the ILC, IBC and the Network server software, and provide global supervisory control functions over the control devices connected to the BMS. It shall be capable of executing application control programs to provide:
 - 1. Calendar functions
 - 2. Scheduling
 - 3. Trending
 - 4. Alarm monitoring and routing
 - 5. Time synchronization
 - 6. Integration of LonWorks controller data, Modbus controller data and BACnet controller data
 - 7. Network Management functions for all LonWorks based devices
- C. The Network Area Controller must provide the following hardware features as a minimum:
 - 1. Two Isolated Ethernet Ports – 10/100 Mbps
 - 2. One RS-232 port
 - 3. One RS-485 port
 - 4. One LonWorks Interface Port – 78KB FTT-10A
 - 5. Battery Backup
 - 6. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 10 gigabyte storage capacity)
 - 7. The NAC must be capable of operation over a temperature range of 32 to 130 deg F(0 to 55 deg C)
 - 8. The NAC must be capable of withstanding storage temperatures of between 32 to 158 deg F(0 to 70 deg C)
 - 9. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 10 simultaneous users.
- E. Event Alarm Notification and actions
 - 1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
 - 2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.

3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object "runtime" and for event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. Alarms shall be annunciated in any of the following manners as defined by the user:
 - a. Screen message text
 - b. Text or email of the complete alarm message to multiple recipients. Provide the ability to route and send alarms based on:
 - 1) Day of week
 - 2) Time of day
 - 3) Recipient
9. Graphic with flashing alarm object(s)
10. Printed message, routed directly to a dedicated alarm printer
11. The following shall be recorded by the NAC for each alarm (at a minimum):
 - a. Time and date
 - b. Location (building, floor, zone, office number, etc.)
 - c. Equipment (air handler #, access way, etc.)
 - d. Acknowledge time, date, and user who issued acknowledgement.
 - e. Number of occurrences since last acknowledgement.
12. Alarm actions may be initiated by user defined programmable objects created for that purpose.
13. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
14. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
15. Provide a "query" feature to allow review of specific alarms by user defined parameters.
16. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
17. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. Data Collection and Storage

1. The NAC shall have the ability to collect data for any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
3. Designating the log as interval or deviation.
4. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
5. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

6. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
7. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
8. All log data shall be stored in a relational database and the data shall be accessed from a standard Web Browser.
9. All log data, when accessed from the Network server software (NS), shall be capable of being manipulated using standard SQL statements.
10. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
11. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.
12. The NAC shall have the ability to archive its log data to Network server software on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the log (buffer size)
 - c. Archive when log has reached it's user-defined capacity of data stores
 - d. Provide ability to clear logs once archived

G. Audit Logs

1. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive the log based on time to the Network server software. For each log entry, provide the following data:
 - a. Time and date
 - b. User ID
 - c. Change or activity: i.e., Change set-point, add or delete objects, commands, etc.

H. Database Back-Up and Storage

1. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
2. Copies of the current database and, at the most recently saved database shall be stored on the Network server software. The age of the most recently saved database is dependent on the user-defined database save interval.
3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.6 NETWORKS

- A. The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network.
- B. Local area network minimum physical and media access requirements:
 1. Ethernet; IEEE standard 802.3
 2. Cable; 10 Base-T, UTP-8 wire, category 5E or 6

3. Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

2.7 NETWORK ACCESS

- A. Owners WAN / LAN Access: Controls Installer must adhere to Owner's policy and requirements to obtain Owner's WAN access.

2.8 GRAPHICAL USER INTERFACE (GUI)

- A. The graphical component of the BMS is of critical importance and should consider the following descriptions and graphic representations to be the minimum acceptable. Enhanced graphics shall include detailed 2-dimensional building site and floor plan graphics, 3-dimensional equipment graphics with fan, damper and valve animations providing operators an aid to comprehending complex system operation. Every graphic page shall contain a tabular and cascading menu navigational structure, established in an HTML frame based format to allow immediate "one-click" access to other building systems without the need to back up through the navigational tree.
- B. Navigation is done through the use of an HTML-based menu bar. The contents of the menu bar shall be customized to match the specific requirements of each building, while retaining the same general categories for consistency and familiarity.
 1. The menu bar shall employ cascading menus. With this navigation concept, the operator shall not be more than two mouse button operations from any view. Some examples of the operator screens follow.
 2. Displays shall provide real-time information with visual display of alarm condition by change of color and/or flashing text/color background.
 3. Displays can be viewed from a non-proprietary, commercial Web Browser.
 4. Points that have been defined as data-writes, either as a digital (on/off) or analog (change value) point type, will be setup such that an operator, by right-clicking the data object or graphic, will be able to command a digital value, or modify an analog value. Operators shall view equipment status from the menu. Menu items shall include headings for major equipment categories such as Air Handling Units, Boiler, Chillers, Zone Control, Lighting, etc. Cascading menus from each major category, shall allow the operator to select a particular piece of equipment; i.e. AHU-1 or Chiller.
 5. A maximum of 40 points will be provided in a single status display screen. Points that have been defined as data-writes, either as a digital (on/off) or analog (change value) point type, shall be setup such that an operator, by right-clicking the data object or graphic, shall be able to command a digital value, or modify an analog value.
- C. All Graphics and schedules will reside at the supervisory software level and not at the NAC level to allow for "one password" access to all NACs on the system and global scheduling and trending.

2.9 CUSTOM GRAPHICS - REQUIRED

- A. Home Page
 1. The building site overview shall provide a "mouse over" function to highlight the floor plan area to be accessed as a navigational aid. Room numbers and/or names will be included at the owner's request. Critical data points, i.e. Outdoor Air Temperature, Outdoor Air Relative Humidity, Hot

Water Supply Temperature, Chilled Water Supply Temperature or National Weather Service data will be continuously visible, in real time, within the HTML frame on all screens. Additional points may be added or deleted at the owner's request without cost.

B. Floor Plans

1. Detailed floor plans shall be created with a vector drawing program accurately depicting the actual building layout to include all rooms, walls, and hallways. All space sensors shall be accurately placed in their actual locations and tagged with their real time space temperature and equipment each is associated with, i.e. 72.5°F/RTU-1, 74.2°/AHU-1, 73.4°/TU-1. Floor plans too large to be practically shown with data points will provide a "mouse over" function to highlight the floor plan area to be accessed. Room numbers and/or names will be included at the owner's request.

C. Mechanical Systems

1. Detailed graphics for each mechanical system shall include; AHUs, RTUs, HXs, CW Piping and Pumps, HW Piping and Pumps, HPs, TUs, and EFs as a minimum. Mechanical systems shall include on-screen access to their respective set-points, trend logs and schedule. All time schedules will be setup as directed by the owner prior to final job turnover.
2. Dynamic trends of all data points shall be set up (specification will be followed as to actual number of trend points possible) prior to final job turnover. Each trend will be available directly on screen for quick trend access.
3. Data points will be shown for all relevant inputs and outputs and be positioned near the actual device. Analog and digital parameters will be able to be modified directly from the equipment screen.

D. Terminal Units

1. Terminal units such as heat pumps, fan coil units, unit ventilators, reheat coils, booster coils and VAV boxes will depict the actual configuration of the equipment controlled. Actual equipment configurations from manufacturers web sites and/or photos of installed equipment shall be used to ensure graphic depictions are as "near actual" as possible.

E. Schedules

1. Graphical schedules shall allow the operator to adjust time of day schedules by dragging the On Event slider. An unlimited number of On/Off events shall be allowed for each schedule and schedules can be linked into a Master/Slave scheduling scheme. Schedules shall allow the user to add/edit/delete holiday and special event schedules. Schedules shall be included for each major piece of equipment.

F. Logging

1. Logs shall be provided for all points defined as requiring collection and archiving of their real-time values. Log data will be provided in HTML, XML, comma- and tab-separated value, and plain-text formats.
 - a. Coordinate with Owner and Engineer for required points for logging.
 - b. Each of the following of point types shall be continuously trended. The user shall have the ability to select up to 3 points to be displayed on a single trending graph.
 - 1) All Temperatures
 - 2) All Temperature setpoints

- 3) All Damper Positions
 - 4) All Valve Positions
 - 5) All VFD %
 - 6) All Airflows
 - 7) All Occupancy statuses
 - 8) All Enthalpies
 - 9) All Humidity's
 - 10) All CO2s
2. Setup parameters for each log include; log intervals, number of collection samples, log collection times and archive times, delta logging with change value selection, etc.
 3. For every log, the data shall be viewable in both tabular and chart formats.
 4. Logs shall be archived to the server software daily at a user specified time of day. Archive data shall be available from the creation time of the log until the last archive time.
 5. For every log, the data can be viewed in both tabular and chart formats.
 6. Logs and archives will be accessible from a Web Browser (Internet Explorer 5.0 or greater).
 7. Analog Logs: Value Collected every 15 minutes for a log total of 2 days.

2.10 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMS, shall not be acceptable.
- C. The Web browser client shall support at a minimum, the following functions:
 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
 2. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
 3. Storage of the graphical screens shall be in the NAC or server software, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
 4. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
 5. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
 - a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
 - 1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
 - 2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.

- b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
 - c. View logs and charts
 - d. View and acknowledge alarms
 - e. Setup and execute SQL queries on log and archive information
6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
 7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.11 SERVER SOFTWARE FUNCTIONS AND HARDWARE

- A. The server software shall be provided. The server software shall support all TCP/IP connected to the control system router.
- B. The Network server software shall provide the following functions, at a minimum:
 1. Global Data Access: The server software shall provide complete access to distributed data defined anywhere in the system.
 2. Distributed Control: The server software shall provide the ability to execute global control strategies based on control and data objects in any control system in the network, local or remote.
 3. The server software shall include a master clock service for its subsystems and provide time synchronization for all control systems.
 4. The server software shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
 5. The server software shall provide scheduling for all control systems and their underlying field control devices.
 6. The server software shall provide demand limiting that operates across all control systems. The server software must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
 7. The server software shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to control systems. Systems not employing this prioritization shall not be accepted.
 8. Each control system supported by the server software shall have the ability to archive its log data, alarm data and database to the Network server software, automatically. Archiving options shall be user-defined including archive time and archive frequency.
 9. The server software shall provide central alarm management for all control systems supported by the server software. Alarm management shall include:
 - a. Routing of alarms to display, printer, email and pagers
 - b. View and acknowledge alarms
 - c. Query alarm logs based on user-defined parameters
 10. The server software shall provide central management of log data for all control systems supported by the server software. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:

- a. Viewing and printing log data
- b. Exporting log data to other software applications
- c. Query log data based on user-defined parameters

C. Server software Hardware Requirements: supplied by

1. The system integrator will be responsible for loading and testing the software on the PC.
2. The system integrator will coordinate with the owner for testing and authorization.

2.12 SYSTEM PROGRAMMING

- A. The Graphical Development Tool (GDT) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. The programming toolset will be provided to the owner as part of this project. The programming software shall be the same programming toolset as used by the contractor's engineers when programming this project. Access to the programming functions and features of the GDT shall be through password access as assigned by the system administrator.
- B. The GDT shall be available in two versions; a thick-client version licensed to the computing platform on which it is installed and a thin-client version, capable of providing the complete set of engineering functions through a standard Web Browser. Programming and development tools not capable of providing all engineering and application development functions with a standard Web Browser are not acceptable.
- C. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. All graphics must be created with a vector 3-D imaging software package, i.e., Dream Weaver, Illustrator, Cool 3-D or other commercially available graphics package.
- D. Programming Methods
 1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
 2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
 3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

4. All programming shall be done in real-time. Systems requiring the uploading on the owner's IT network, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.13 OBJECT LIBRARIES

- A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
- C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.
- D. The library shall include applications or objects for the following functions, at a minimum:
 1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
 2. Calendar Object. The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
 3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
 4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
 5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
 6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the

users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

- E. The library shall include control objects for the following functions. All control objects shall conform to the Johnson Controls Metasys objects.
1. Analog Input Object - Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 2. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
 3. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
 4. Binary Input Object - The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 5. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
 6. Binary Output Object - Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The a command prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked.
 7. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
 8. PID Control Loop Object - Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
 9. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
 10. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
 11. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

12. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
 13. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
 14. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
 15. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.
- F. The object library shall include objects to support the integration of devices connected to the Network Area Controller or server software. At a minimum, provide the following as part of the standard library included with the programming software:
1. Johnson Controls devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide manufacturer-specific objects to facilitate simple integration of these devices. All network variables shall be supported. Information (type and function) regarding network variables not defined in the N2 profile shall be provided by the device manufacturer.

2.14 OTHER CONTROL SYSTEM HARDWARE

- A. Ethernet Switches
1. 8 Port 10/100 MBPS Switch / Hub
 2. Din Rail Mounted
 3. LED communication indicators
- B. Temperature Sensors and Transmitters
1. General Sensor & Transmitter Requirements

- a. Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.
 - b. Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
 - c. Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and provide a true linear output signal.
 - d. Temperature sensors shall be of the resistance type and shall be 10K or 20K Ohm Thermistor type.
 - 1) Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the controllers operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 50 ohm/°C. resistance change versus temperature to insure good resolution and accuracy.
 - e. The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.
 - 1)

<u>Point Type</u>	<u>Accuracy</u>
Outside Air	+/-3%
Chilled/Hot Water	+/-1%
Room Temperature	+/-1%
Duct Temperature	+/-3%
 - 2) Sensors used in energy or process calculations shall be accurate over the process temperature range. Submit a manufacturer's calibration report indicating that the calibration certification is traceable to the National Bureau of Standards (NBS) Calibration Report Nos. 209527/222173.
2. Thermowells
- a. When thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and Greenfield fitting, except where wells are to be installed under separate contract.
 - b. Thermowells shall be pressure rated and constructed in accordance with the system working pressure
 - c. Thermowells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
 - d. Thermowells shall be constructed of the following materials:
 - 1) Hot Water; brass.
 - 2) Chilled Water; brass.
3. Outside Air Sensors
- a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element.
 - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

- d. Solar load sensors shall be provided in locations shown. The use of a thermistor combined with a solar compensator is acceptable. Provide calibration charts as part of the O&M Manual.
4. Duct Type Sensors
 - a. Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
 - b. Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.
 - c. For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.
 5. Averaging Duct Type Sensors
 - a. Where called out on the drawings and points lists, provide averaging type duct sensors. Thermistor sensors are acceptable. The sensor shall be multi-point sensitive through the length of the temperature conducting tubing. The thermistors shall be configured in a series / parallel method which creates an end result of total average resistance equal to the same span as a standard thermistor.
 - b. Provide capillary supports at the sides of the duct to support the sensing element.
- C. Relative Humidity Sensors/Transmitters
1. The sensor shall be a solid state, resistance type relative humidity sensor of the Bulk Polymer Design. The sensor element shall be washable and shall resist surface contaminations.
 2. Humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2 wire isolated loop powered, 4-20ma, 0-10.0 VDC linear proportional output.
 3. The humidity transmitter shall meet the following overall accuracy including lead loss and A to D conversion.
 - a. Room Type Sensor $\pm 2\%$ RH
 - b. Duct Type Sensor $\pm 2\%$ RH
 4. Outside air relative humidity sensors shall be installed in a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
 5. Provide a single point humidity calibrator, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 6. Duct type sensing probes shall be constructed of 304 stainless steel and be equipped with a neoprene grommet, bushings and a mounting bracket.
- D. Differential Pressure Transmitters and Accessories
1. General Air and Water Pressure Transmitter Requirements:
 - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - b. Pressure transmitters shall provide the option to transmit a 0 to 5V dc, 0 to 10V dc, or 4 to 20 mA output signal.
 - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (3 valve manifolds).

- d. Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.
 - e. Low air pressure, differential pressure transmitters used for room pressurization control (i.e. laboratories, OR's clean rooms, etc.) shall be equipped with a LED display indicating the transmitter output signal.
 - f. Duct sensing pressure applications where the velocity exceeds 1500 fpm shall utilize a static pressure traverse probes.
2. Low Air Pressure Applications
 - a. The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.
 - 1) Span: Not greater than two times the design space DP.
 - 2) Accuracy: Plus or minus 0.5% of F.S.
 - 3) Dead Band: Less than 0.3% of output.
 - 4) Repeatability: Within 0.2% of output.
 - 5) Linearity: Plus or minus 0.2% of span.
 - 6) Response: Less than one second for full span input.
 - 7) Temperature Stability: Less than 0.05% output shift per degree change.
 - b. The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.
 3. Medium to High Air Pressure Applications
 - a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter except the performance specifications are not as severe. Provide differential pressure transmitters which meet the following performance requirements.
 - 1) Zero & span: (% F.S./Deg. C): .05% including linearity, hysteresis and repeatability
 - 2) Accuracy: 1% F.S. (best straight line)
 - 3) Static Pressure Effect: 0.5% F.S.
 - 4) Thermal Effects: $\pm 0.05\%$ F.S. /Deg. C.
- E. Low Differential, Water Pressure Applications
- F. Low Differential, Water Pressure Applications (**10 KPa to 5 KPa**)
1. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20mA output in response to variation of flow meter differential pressure or water pressure sensing points.
 2. The differential pressure transmitter shall have non-interactive zero and span adjustments adjustable from the outside cover and meet the following performance specifications.
 - a. 0 – 10 input differential pressure range
 - b. 0 – 10 **[KPa]** input differential pressure range
 - c. 4 - 20 mA output
 - d. Maintain accuracy up to 20 to 1 ratio turndown
 - e. Reference Accuracy: $\pm 0.2\%$ of full span
 3. Provide a two year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the Owner during the warranty period.
- G. Medium to High Differential Water Pressure Applications

1. The differential pressure transmitter shall meet the low pressure transmitter specifications except the following:
 - a. Reference Accuracy: $\pm 1\%$ of full span (includes non-linearity, hysteresis, and repeatability)
 - b. Warranty: 1 year.
2. Bypass Valve Assembly: Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided

H. Electronic Valve And Damper Actuators

1. General Requirements
 - a. Electronic actuators shall be electric, direct-coupled type capable of being mounted over the shaft of the damper. They shall be UL listed and the manufacturer shall provide a 2 year unconditional warranty from the date of commissioning. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts or 4 VA for VAV actuators. Sound level shall not exceed 45 dB for high torque or 35 dB for VAV actuators.
 - b. Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burn-out. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.
 - c. Warranty must be two years by manufacturer on actuator as a whole and all components.
 - d. Control devices shall be at 0 volts.
2. Control Damper Actuators
 - a. OA (outside air), RA (return air), and EA (exhaust air) actuators shall be spring return type for safety functions. Individual battery backup, capacitor return is not acceptable.
 - b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within $\pm 1/21$ of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating damper position. Accuracy shall be within $\pm 2.5\%$.
 - c. Face and bypass dampers and other control dampers shall be modulating using the same control circuit detailed above but shall not be spring return.
3. Miscellaneous Damper Actuators
 - a. OA combustion and ventilation air intake and EA damper actuators shall be 2 position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used.
 - b. Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air.
4. Air Terminals
 - a. Air terminal actuators shall use fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controllers' requirements.

5. Combination Smoke and Fire Damper Actuators
 - a. Actuators shall be factory mounted and connected to the damper section and shall conform to UL 555S specifications.

I. Valve Actuators

1. Control Valves Actuators (3 inch and smaller)
 - a. Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.
 - b. The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.
 - c. Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.
 - d. Linkages shall be metal.
2. Control Valve Actuators (4 inch and larger).
 - a. The valve actuator shall consist of a permanent split capacitor, reversible type electric motor which drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 8 meters, showing output shaft and valve position. Unit shall be mounting directly to the valves without brackets and adapters, or readily adapted to suit all other types quarter-turn valves.
 - b. The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.
 - c. The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.
 - d. The actuator shall have a self-locking gear train which is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with 70 N-m or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shaft shall run in ball bearings at each end of motor.
 - e. The actuator housing shall be hard anodized aluminum for full environmental protection.
 - f. The environmental temperature range of the actuator shall be -22 to 140 deg F(-30 to +60 deg C).
 - g. For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 104 deg F(40 deg C).
 - h. The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in

each direction of 90° rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.

- i. Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cut-out protector shall be embedded in the motor windings to limit heat rise to 175 deg F(80 deg C) in a 104 deg F(40 deg C) ambient. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.
- j. Materials of Construction: The electric actuator shall have a pressure die-cast, hard anodized aluminum base and cover. The compound gear shall be made of die-cast, hard anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.
- k. Accessories:
 - 1) Potentiometer for providing continuous feedback of actuator position at the controller (for valves specified position feedback).
- l. Acceptable manufacturers:
 - 1) Honeywell
 - 2) Johnson Controls
 - 3) Belimo

J. Control Valves

1. Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5 ft of head pressure drop at rated flow (except as may be noted on the drawings). Valves with sizes up to and including NPS 2 (DN 50) shall be "screwed" configuration and NPS 2-1/2 (DN 65) inch and larger valves shall be "flanged" configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.
2. Acceptable manufacturers:
 - a. Honeywell
 - b. Belimo

K. Switches

1. Differential Pressure Switches
 - a. All pressure sensing elements shall be corrosion resistant. Pressure sensing elements shall be bourdon tubes, bellows, or diaphragm type. Units shall have tamper-proof adjustable range and differential pressure settings.
 - b. Pressure sensor switch contacts shall be snap action micro-switch type. Sensor assembly shall operate automatically and reset automatically when conditions return to normal. Complete sensor assembly shall be protected against vibration at all critical movement pivots, slides and so forth.
 - c. Differential pressure switches shall be vented to withstand a 50% increase in working pressure without loss of calibration.
2. Electric Low Limit Thermostat (Freeze Stat)

- a. Duct type, fixed 4 deg F(3 deg C) differential, range 32 to 60 deg F(0 to 15 deg C). Sensing element shall be a 20 feet(6m) long capillary tube responding to the lowest temperature sensed along any 12 inches(305 mm) of bulb length. Switch shall be SPDT 120/240 volts AC, rated for 10 amps at 120 volts full load. Unit shall be manually reset. Provide one low limit thermostat for each 20 sq. ft.(1.86 sq. m) or fraction thereof of coil surface area.
 - b. Provide DPST switches, 1 NO, 1 NC contact.
 - c. Provide manual type low limit thermostat set at 36 deg F(2 deg C) on each air handling unit.
 - d. Provide thermostat override on air handling units for smoke control in area being served.
3. Water Flow Switches
- a. UL listed, suitable for all service application conditions. Body minimum working pressure rating shall equal or exceed service pressure. Switch electrical rating shall be 230 volts AC 3.7 ampere, 115 volts AC 7.4 ampere, and 125 VAC 115-230 VAC AC Pilot duty. Unit shall have two SPDT switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop exceeding 2 psi at maximum system flow rate.
4. Strap-On Aquastat
- a. UL listed, provided with a suitable removable spring clip for attaching aquastat to pipe and a snap-action SPDT switch. Switch set-point shall be as indicated. Electrical rating shall be 5 amperes, 120 VAC.
5. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- L. Flow, Pressure And Electrical Measuring Apparatus
1. Shielded Static Pressure Sensor
 - a. Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
 - b. These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 1000 feet/min.(300 m/min) from a radial source.
 - c. The shielded static sensing devices shall be used for both reference and space pressure sensing.
 - d. Pressure sensors used for outside air pressure reference purposes shall be equipped with a conduit seal for pneumatic tubing and bushings for a weather tight installation.
 2. Static Pressure Traverse Probe
 - a. Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.
 - b. Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.
 - c. The duct static traverse probe shall be of 304 stainless steel construction and (except for 3/4" dia. probes with lengths of 24 inches(610 mm) or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure

signal fitting. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure without need for correction factors, with an instrument accuracy of $\pm 1/2\%$.

M. Relays And Contactors

1. Relays other than those associated with digital output cards shall be general purpose, enclosed type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.
2. Solid State Relays (SSR): Input/output isolation shall be greater than IOE⁹ ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10×10^6 operations or greater. The ambient temperature range of SSRs shall be -18 to 140 deg F (-28 To +60 deg C). Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be provided as an integral part of the relay.
3. Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contractor shall be double-break-silver-to-silver type protected by arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.

N. Temperature Control Panels

1. Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Panels shall conform to NEMA 1 standards, unless otherwise indicated.
2. Control panels shall meet all requirements of UL508A and shall be so certified.
3. All external wiring shall be connected to terminal strips mounted within the panel.
4. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels and the identification number of the panel.
5. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.
6. Uninterruptable Power Supplies
 - a. Lithium Battery
 - b. Integral mounting brackets for mounting within cabinet
 - c. Minimum 350 VA/200W capacity
 - d. 6 Minute protection with 200W Load
 - e. 5 year electronics and battery warranty
 - f. 312 Joule surge suppression
 - g. 2-6ms transfer time
 - h. Minimum 3 receptacles
 - i. UL-1778, cTUVus, FCC, and RoHS Approvals
 - j. USB communications interface
 - k. Based on Xtreme Power Conversion J60

O. Variable Frequency Drives (VFDs)

1. Contractor responsibilities:
 - a. Adequately size the VFD for the application
 - b. Furnish and install VFD(s)
 - c. Program and configure the VFD(s)
 - d. Provide documentation of VFD control wiring and parameters altered from defaults.

2. Environmental / Operating Requirements
 - a. The VFD enclosure shall be suitable for the environment in which it will be installed.
 - b. VFD shall be suitable for the voltage available at the area of installation. Electrical contractor responsible for removing jumpers or making other similar adjustments to accommodate an ungrounded delta supply voltage (3-phase, 3-wire) when necessary. The VFD shall maintain functionality from -15% to +10% of nominal voltage at a frequency of 45-66 Hz. Ambient operating temperature range shall be 14 F to 104 F, and the humidity range: 5 to 95% RH (non-condensing).
 - c. Variable frequency drives shall be UL listed and sized for the power and loads applied.
 - d. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used.
 - e. All VFDs over 3 horsepower shall be provided with an AC choke before rectifiers. All included chokes and filters shall be integrated in the factory enclosure.
 - f. VFDs shall be installed in strict conformance to the manufacturer's installation instructions.
3. Inputs and Outputs
 - a. The VFD shall accommodate inputs of 0-10 VDC, 4-20 mA, up to six digital inputs. VFD outputs shall include current of 0-20 mA, 500 ohm maximum with 10 bit resolution, and two programmable changeover relay outputs with switching capacity of 24 VDC, 8A; 250 VAC, 8A; and 125 VDC, 0.4A.
4. Communication / Control Protocols
 - a. The selected VFD shall be compatible with the communication and controls protocol of the Johnson Controls Metasys control system.
5. User Interface
 - a. The VFD shall have an integral keypad and alphanumeric "plain-language" display unit for user interface.
 - b. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of faults, frequency, unit temperature, and motor speed, current, torque, power, voltage, and temperature.
 - c. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).
6. Programmable Features
 - a. The variable frequency drive shall have separate pre-loaded user-programmable applications which can be modified using a personal computer-based commissioning tool with an optional software package, or an alpha-numeric LCD user interface. Aforementioned application functionality shall include but not be limited to:
 - 1) Basic Functionality Application providing the following:
 - a) Control I/O signals (two (2) analog inputs, one (1) digital input, and one (1) analog output) are fixed

- b) One (1) programmable digital input and one (1) programmable digital output
 - c) All parameters have default values,
 - 2) Expanded Functionality Application providing all capabilities in the previous application as well as the following:
 - a) One (1) programmable digital input and all outputs are programmable
 - b) Frequency limit and prohibit capability
 - c) Programmable start/stop and reversing logic
 - d) Automatic restart
 - e) Programmable actions for motor thermal and stall protection
 - f) DC brake at stop
 - 3) Application that provides all previously mentioned capability as well as enabling the use of two different control and frequency sources. Each source must be programmable.
 - 4) Application which provides all functionality from the Expanded Functionality Application as well as accommodates multiple, required fixed speed references.
 - 5) PID Control Application – Uses internal PID control loop to control motor frequency as well as providing:
 - 6) Input and output phase supervision
 - 7) Programmable capability for three (3) digital inputs and all outputs
 - 8) Sleep function
 - 9) Multi-purpose Control Application – The frequency reference can be selected from analog inputs, joystick control, motor potentiometer, or a mathematical function of the analog inputs.
 - 10) Application specifically designed to control one leading variable speed drive and up to 3 auxiliary drives.
7. Alarms/Faults
- a. Three types of faults shall be monitored, “FAULT” shall shut the motor down, “FAULT Auto-reset” shall shut the motor down and try to restart it for a programmable number of tries, and “FAULT Trip” shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:
 - 1) Over current
 - 2) Over voltage
 - 3) Earth ground
 - 4) Emergency stop
 - 5) System (component failure)
 - 6) Under voltage
 - 7) Phase missing
 - 8) Heat sink under temperature
 - 9) Heat sink over temperature
 - 10) Motor stalled
 - 11) Motor over temperature
 - 12) Motor underload
 - 13) Cooling fan failure
 - 14) Inverter bridge over temperature
 - 15) Analog input control under current
 - 16) Keypad failure
 - 17) Other product unique monitored conditions
 - b. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds), output frequency,

motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 10 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 10 shall overwrite the oldest faults.

8. Acceptable manufacturers – check with the owner for what manufacturer and model preferences they have. If they don't have a preference here are acceptable manufacturers:
 - a. ABB
 - b. Honeywell
 - c. Square D
 - d. Danfoss
9. Disconnects
 - a. Lockable fused disconnect upstream of VFD
 - b. Lockable non-fused disconnect with break before main break auxiliary contact within sight of the VFD motor. Wire the NC aux contact in series with the start/run/enable signal.
- P. Any automatic control dampers not specified to be integral with other equipment. Frames shall not be less than 0.094 inch(2.39 mm) galvanized steel. Blades shall not be over 8 inches(200 mm) wide nor less than 0.063 inch(1.52 mm) galvanized steel roll formed. Bearings shall be oilite, ball-bearing or nylon with steel shafts. Side seals shall be stainless steel of the tight-seal spring type. Dampers and seals shall be suitable for temperature ranges of -40 to 200 deg F(-40 to 93 deg C).
 1. Individual damper sections shall have a maximum of 16 sq. ft.(1.49 sq. m) of damper surface and each individual damper section to have its own damper operator.
 2. All proportional control dampers shall be opposed blade type and all two-position dampers shall be parallel blade types.
 3. Dampers shall be sized to meet ductwork or opening size.
 4. Dampers shall be ultra-low leakage dampers and the blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage to 6 CFM per square foot for dampers in excess of sixteen inches square at 1-inch wg(250 Pa).
- Q. Thermally Isolated Dampers: Ruskin Model CDT150 or equivalent extruded aluminum thermally isolated control dampers with insulated air-foil shaped blades.
- R. Digital Wall Module: Each wall module shall provide temperature indication to the digital controller.
 1. Provide software-limited set point adjustment and occupied/unoccupied override capability where indicated.
 2. Module mounted adjustments shall use buttons, no slides or wheels.
 3. Where indicated, provide plate type security temperature sensors.
- S. Wireless Temperature Transmitter: Module shall provide temperature indication to the digital system.
 1. Supply Power: Lithium batteries, 8 year battery life at 10 second transmit rate
 2. Inputs: Built in thermistor
 3. Accuracy: ± 0.2 °C
 4. Transmitted Range: -40° to 85°C
 5. Environmental Operation Range:
 - a. Temp: 0° to 60°C

- b. Humidity: 5% to 95% RH non-condensing
- 6. Material: ABS Plastic
- 7. Material Rating: UL94 V-0
- 8. Radio Frequency: 418 MHz
- 9. Transmitter Interval: ~10 seconds
- 10. Antenna: Built inside the enclosure
- 11. Associated Products:
 - a. 418 or 900 MHz Receivers: Receives the RF signal from one or more transmitters or repeaters and outputs the values to Analog Output Modules.
 - b. Analog Output Modules: Converts the signal from the Receiver into a resistance, voltage or current for sending to the controller.
 - c. Repeater: Extends the range of the Transmitter up to 1,000 feet.
- T. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be $\pm 2\%$ of actual reading from 0.4 to 20 feet per second (0.12 to 6.1 meters per second) flow velocities.
- U. Duct smoke detectors shall be furnished and connected to the building fire alarm under Division 28. Contacts shall be provided for the BMS contractor to connect for fan shutdown as specified in the Sequence of Operations.
- V. Carbon Dioxide sensors shall be 0-10 Vdc analog output type, with corrosion free gold-plated Non-dispersive Infrared sensing, designed for duct mounting. Sensor shall incorporate internal diagnostics for power, sensor, analog and output checking, and Automatic Background Calibration algorithm for reduced maintenance. Sensor range shall be 0-3000 PPM with $\pm 5\%$ and ± 50 PPM accuracy.

PART 3 - EXECUTION

3.1 GENERAL

- A. The BMS shall be designed, installed, and commissioned in a turnkey operational manner; including all labor not noted in Work by Others paragraph of PART I of this section of these specifications, and not noted in other sections of these specifications.
- B. Where control devices are installed on insulated piping or ductwork, provide standoff brackets or thermowells sized to clear insulation thickness. Provide extended sensing elements, actuator linkages, and other accessories as required.

3.2 SEQUENCE OF OPERATION

- A. Refer to the control drawings.

3.3 INSTALLATION

- A. All controls Installer work shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work.
- B. Line and low voltage electrical connections to control equipment shall be provided by the controls Installer in accordance with these specifications.
- C. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.
- D. All wiring and tubing shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All tubing and wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications. All electronic wiring shall be #18 AWG minimum THHN clear coated and shielded if required, except standard network cabling shall be as tested and recommended in lieu of #18 gauge twisted. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.
 - 1. Low voltage system cables shall be neatly routed and independently supported with cable rings to the nearest cable tray, technology closet, conduit run or equipment connection.
 - 2. All wiring in ceiling plenums shall be plenum rated.
- E. This contractor shall provide all sensing, control, and interlock wiring and tubing for the following unless shown or specified elsewhere by others:
 - 1. Boiler interlocks.
 - 2. Condensing units interlocks.
 - 3. Hydronic piping pressure sensors.
 - 4. CO2 sensors.
 - 5. Connection between occupancy sensors provided by Division 26 and control devices.
 - 6. Smoke detection devices and HVAC equipment shut-down devices.
- F. The controls contractor shall install all software and enter all computer data into the network area controllers, hardware, and related computers including all control programs, initial approved parameters and settings, and graphics.
- G. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install wall-mounting devices in electrical outlet boxes at heights to match lighting controls.
- H. For airflow monitoring devices, perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After substantial completion of airflow system, start units to confirm proper operation and readings. Remove and replace malfunctioning units and retest.
 - 2. Test calibration to confirm proper operation and readings.

- I. Install VFCs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on freestanding lightweight racks bolted to wall or floor. Do not mount to vibrating equipment.

3.4 ACCEPTANCE

- A. The BMS contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations.
 1. Coordinate with other Installers the checkout of each controlled system
- B. The controls Installer shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- D. System Acceptance: Satisfactory completion is when the controls Installer has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.5 TRAINING

- A. All training shall be by the BMS Installer and shall utilize operators' manuals and as-built documentation.
- B. The controls Installer shall provide 40 hours of instruction to the Owner's designated personnel on the operation of the BMS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS shall include, but not be limited to; device programming software, graphical development software, graphical user interface, the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in three sessions as follows:
 1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Owners' personnel can start to familiarize themselves with the system before training begins.
 2. Follow-Up Training: Two one day sessions (8 hours each) after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
 3. Warranty Follow Up: Two one day sessions (8 hours each) to be scheduled at the request of the Owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.
- D. On-Line Service: Include 40 hours of on-line service assistance to include but not be limited to:

1. Programming changes or modifications, including changes and adjustments to control algorithms
2. Graphic changes or modifications as requested by the Owner or consulting engineer.
3. Operator assistance to include short (1 hour or less) refresh training on system diagnostics and operation, i.e., geothermal optimization, scheduling, trending or operator setup.
4. Consulting engineer assistance to include assistance on control system optimization.

3.6 POINTS LIST

- A. Refer to the control drawing. Provide all additional points as required to accomplish all BMS sequences indicated in the drawings and specifications.

END OF SECTION 23 0900

SECTION 23 1123 - FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Mechanical sleeve seals.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig(690 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig(3.45 kPa) or less but not more than 5 psig(34.5 kPa).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Indicate pressure ratings and capacities.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than five days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without Construction Manager's and Owner's written permission.

1.8 COORDINATION

- A. Coordinate the installation of the natural gas service by the local gas utility.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Face: Lapped.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel.
- B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
3. Operating-Pressure Rating: 0.5 psig(3.45 kPa).
4. End Fittings: Zinc-coated steel.
5. Threaded Ends: Comply with ASME B1.20.1.
6. Maximum Length: 72 inches(1830 mm).

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2(DN 50) and smaller; flanged ends for NPS 2-1/2(DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig(862 kPa).

C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Manual Gas Shutoff Valve Schedules" below for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2(DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig(862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Tamperproof Feature: Locking feature for valves indicated in "Manual Gas Shutoff Valve Schedule" Articles.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch(25 mm) and smaller.

5. Service Mark: Valves 1-1/4 inches(32 mm) to NPS 2(DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2(DN 65) and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig(862 kPa).
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Flanged Ends: Comply with ASME B16.5.
 4. Tamperproof Feature: Locking feature for valves indicated in "Manual Gas Shutoff Valve Schedule" Articles.
 5. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
 2. Ball: Chrome-plated bronze.
 3. Stem: Bronze; blowout proof.
 4. Seats: Reinforced TFE; blowout proof.
 5. Packing: Threaded-body packnut design with adjustable-stem packing.
 6. Ends: Threaded.
 7. CWP Rating: 600 psig(4140 kPa).
 8. Listing: Valves NPS 1(DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B 584.
 2. Plug: Bronze.
 3. Ends: Threaded or flanged.
 4. Operator: Square head or lug type with tamperproof feature where indicated.
 5. Pressure Class: 125 psig(862 kPa).
 6. Listing: Valves NPS 1(DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A 126, Class B.
 2. Plug: Bronze or nickel-plated cast iron.
 3. Seat: Coated with thermoplastic.
 4. Stem Seal: Compatible with natural gas.
 5. Ends: Threaded or flanged.
 6. Operator: Square head or lug type with tamperproof feature where indicated.
 7. Pressure Class: 125 psig(862 kPa).
 8. Listing: Valves NPS 1(DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2(DN 50) and smaller; flanged for regulators NPS 2-1/2(DN 65) and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches(150 mm) wide and 4 mils(0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for

corrosion protection, detectable by metal detector when tape is buried up to 30 inches(750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Locate valves for easy access.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors. Comply with requirements in Division 23 Section "Common Work Results for HVAC."
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches(75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for pressure regulators to outdoors and terminate with weatherproof vent cap.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, and below grade or floors, unless indicated to be exposed to view.
- R. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
 - 2. Underground Piping Beneath Buildings: Install underground piping beneath buildings encased in a code approved conduit designed to withstand superimposed loads and the same pressure as the pipe.
 - 3. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- S. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- T. Connect branch piping from top or side of horizontal piping.
- U. Install unions in pipes NPS 2(DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- V. Do not use natural-gas piping as grounding electrode.
- W. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- X. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- Y. Install automatic gas shutoff valve furnished by food service equipment supplier.
- Z. Make final connection to gas-fired kitchen equipment furnished by food service equipment supplier.

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve at each gas-fired piece of equipment.
- B. Install regulators with maintenance access space adequate for servicing and testing.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- F. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1(DN 25) and Smaller: Maximum span, 96 inches(2438 mm); minimum rod size, 3/8 inch(10 mm).
 - 2. NPS 1-1/4(DN 32): Maximum span, 108 inches(2743 mm); minimum rod size, 3/8 inch(10 mm).
 - 3. NPS 1-1/2 and NPS 2(DN 40 and DN 50): Maximum span, 108 inches(2743 mm); minimum rod size, 3/8 inch(10 mm).

4. NPS 2-1/2 to NPS 3-1/2(DN 65 to DN 90): Maximum span, 10 feet(3 m); minimum rod size, 1/2 inch(13 mm).
5. NPS 4(DN 100) and Larger: Maximum span, 10 feet(3 m); minimum rod size, 5/8 inch(15.8 mm).

3.6 CONNECTIONS

- A. Install piping adjacent to appliances to allow service and maintenance of appliances.
- B. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches(1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
 1. Install pressure regulator at connection to gas-fired appliance and equipment as required to meet maximum gas pressure requirements of that particular device.
- C. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for above ground piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches(300 mm) below finished grade, except 6 inches(150 mm) below subgrade under pavements and slabs.

3.8 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, and piping specialties, except components with factory-applied paint or protective coating.
 1. Color: Gray.
- C. Paint interior exposed metal piping, valves, and piping specialties in mechanical rooms, except components with factory-applied paint or protective coating.
 1. Color: Safety yellow.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
 - C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
 - D. Prepare test and inspection reports.
- 3.10 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG(3.45 kPa) AND LESS THAN 5 PSIG(34.5 kPa)
- A. Aboveground, distribution piping shall be one of the following:
 1. For NPS 2(DN 50) and smaller, use steel pipe with malleable-iron fittings and threaded joints.
 2. For NPS 2-1/2(DN 65) and larger, use steel pipe with wrought-steel fittings and welded joints.
- 3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE
- A. Distribution piping valves for pipe sizes NPS 2(DN 50) and smaller shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.
 - B. Distribution piping valves for pipe sizes NPS 2-1/2(DN 65) and larger shall be one of the following:
 1. Bronze plug valve.
 2. Cast-iron, nonlubricated plug valve.
 - C. Valves in branch piping for single appliance shall be one of the following:
 1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.

END OF SECTION 23 1123

SECTION 23 2113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
1. Hot-water heating piping.
 2. Chilled-water cooling piping.
 3. Condensate-drain piping.
 4. Air-vent piping.
- B. Related Sections include the following:
1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
 2. Division 23 Section "Common Work Results for HVAC" for general piping materials and installation requirements.
 3. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe expansion compensating devices for hydronic piping systems.
 4. Division 23 Section "Meters and Gages for HVAC Piping" for thermometers and pressure gages.
 5. Division 23 Section "General Duty Valves for HVAC Piping" for general-duty valves.
 6. Division 23 Section "Hangers and Supports for HVAC Equipment" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
 7. Division 23 Section "Identification for HVAC Piping and Equipment" for labeling and identifying hydronic piping.
 8. Division 23 Section "Instrumentation and Control for HVAC" for temperature-control valves and sensors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
1. Pressure-seal fittings.
 2. Calibrated Balancing Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
 3. Air control devices.
 4. Hydronic specialties.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.
- C. Comply with the provisions of the following:
 - 1. Michigan Mechanical Code

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150.

- D. Malleable-Iron Unions: ASME B16.39; Classes 150.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 125, raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Slip-on or butt welded.
 - 3. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Victaulic Company of America.
 - 2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 4. Refer to Division 23 Section "Hydronic Pumps" for allowable mechanical joint pump accessories.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch(3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

- A. Refer to Division 23 Section "Common Work Results for HVAC" for dielectric fittings.
- B. Dielectric Connections: Ground joint, copper unions, ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends; and suitable system fluid, pressure and temperature.

2.5 VALVES

- A. Butterfly, Check, and Ball Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Furnished by temperature controls provider. Refer to Division 23 Section "Instrumentation and Control for HVAC."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett.
 - b. Tour & Andersson.
 - c. Victaulic Koil Kits
 - d. Flow Design Inc.
 - 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Plug: Resin.
 - 5. Seat: PTFE.
 - 6. End Connections: Threaded or socket.
 - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 8. Handle Style: Lever, with memory stop to retain set position.
 - 9. CWP Rating: Minimum 125 psig(860 kPa).
 - 10. Maximum Operating Temperature: 250 deg F(121 deg C).
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bell & Gossett.
 - b. Tour & Andersson.
 - c. Flow Design Inc.
 - 2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Stem Seals: EPDM O-rings.
 - 5. Disc: Glass and carbon-filled PTFE.

6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig(860 kPa).
11. Maximum Operating Temperature: 250 deg F(121 deg C).

E. Drain Valves:

1. Ball-Valve-Type, Hose-End Drain Valves:
 - a. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - b. Pressure Rating: 400-psig(2760-kPa) minimum CWP.
 - c. Size: NPS 3/4(DN 20).
 - d. Body: Copper alloy.
 - e. Ball: Chrome-plated brass.
 - f. Seats and Seals: Replaceable.
 - g. Handle: Vinyl-covered steel.
 - h. Inlet: Threaded or solder joint.
 - i. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
2. Gate-Valve-Type, Hose-End Drain Valves:
 - a. Standard: MSS SP-80 for gate valves.
 - b. Pressure Rating: Class 125.
 - c. Size: NPS 3/4(DN 20).
 - d. Body: ASTM B 62 bronze.
 - e. Inlet: NPS 3/4(DN 20) threaded or solder joint.
 - f. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.6 AIR CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Bell & Gossett.
 - c. Spirotop
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Inlet Connection: NPS 1/2(DN 15).
6. Discharge Connection: NPS 1/8(DN 6).
7. CWP Rating: 150 psig(1035 kPa).
8. Maximum Operating Temperature: 225 deg F(107 deg C).

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Bell & Gossett.
 - c. Spirotop
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2(DN 15).
6. Discharge Connection: NPS 1/4(DN 8).
7. CWP Rating: 150 psig(1035 kPa).
8. Maximum Operating Temperature: 240 deg F(116 deg C).

2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2(DN 50) and smaller; flanged ends for NPS 2-1/2(DN 65) and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig(860 kPa).

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch(20-mm) misalignment.
4. CWP Rating: 150 psig(1035 kPa).
5. Maximum Operating Temperature: 250 deg F(121 deg C).

C. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig(1035 kPa).
5. Maximum Operating Temperature: 250 deg F(121 deg C).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2(DN 50) and smaller, shall be any of the following:

1. Type L(B), drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 125 cast-iron or Class 150 malleable-iron threaded fittings.

B. Hot-water heating piping, aboveground, NPS 2(DN 65) and larger, shall be the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Condensate-Drain Piping: Type L(B), drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Air-Vent Piping:

1. Inlet: Same as service where installed.
2. Outlet: Type L(B), annealed-temper copper tubing with soldered or flared joints.

3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install shutoff-duty valve and calibrated-orifice balancing valve at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.

- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4(DN 20) drain valve, and short NPS 3/4(DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2(DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2(DN 65) and larger, at final connections of equipment and elsewhere as indicated unless mechanical grooved connections allowed.
- S. Install strainers on inlet side of each in-line pump and elsewhere as indicated. Install NPS 3/4(DN 20) nipple and ball valve in blowdown connection of strainers NPS 2(DN 50) and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2(DN 50).
- T. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 HANGERS AND SUPPORTS

- A. Install structural steel members between building structure members as required for upper attachment of hangers and supports. Use members of size and strength required for span and load. The use of joist or truss bridging for hanging and supporting is prohibited.
- B. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- C. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet(6 m) long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet(6 m) or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet(6 m) or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

- D. Install hangers for steel piping with the following maximum spacing and minimum rod [sizes unless grooved [or pressure sealed fitting]manufacturer requires more frequent support]:
- E. Install hangers for steel piping with maximum spacing and minimum rod in accordance Michigan Mechanical Code or MSS SP-69.
1. NPS 3/4(DN 20): Maximum span, 7 feet(2.1 m); minimum rod size, 1/4 inch(6.4 mm).
 2. NPS 1(DN 25): Maximum span, 7 feet(2.1 m); minimum rod size, 1/4 inch(6.4 mm).
 3. NPS 1-1/2(DN 40): Maximum span, 9 feet(2.7 m); minimum rod size, 3/8 inch(10 mm).
 4. NPS 2(DN 50): Maximum span, 10 feet(3 m); minimum rod size, 3/8 inch(10 mm).
 5. NPS 2-1/2(DN 65): Maximum span, 11 feet(3.4 m); minimum rod size, 3/8 inch(10 mm).
 6. NPS 3(DN 80): Maximum span, 12 feet(3.7 m); minimum rod size, 3/8 inch(10 mm).
 7. NPS 4(DN 100): Maximum span, 14 feet(4.3 m); minimum rod size, 1/2 inch(13 mm).
 8. NPS 5(DN 125): Maximum span, 14 feet(4.3 m); minimum rod size, 1/2 inch(13 mm).
 9. NPS 6(DN 150): Maximum span, 17 feet(5.2 m); minimum rod size, 1/2 inch(13 mm).
 10. NPS 8(DN 200): Maximum span, 19 feet(5.8 m); minimum rod size, 5/8 inch(16 mm).
 11. NPS 10(DN 250): Maximum span, 20 feet(6.1 m); minimum rod size, 3/4 inch(19 mm).
 12. NPS 12(DN 300): Maximum span, 23 feet(7 m); minimum rod size, 7/8 inch(22 mm).
 13. NPS 14(DN 350): Maximum span, 25 feet(7.6 m); minimum rod size, 1 inch(25 mm).
 14. NPS 16(DN 400): Maximum span, 27 feet(8.2 m); minimum rod size, 1 inch(25 mm).
 15. NPS 18(DN 450): Maximum span, 28 feet(8.5 m); minimum rod size, 1-1/4 inches(32 mm).
 16. NPS 20(DN 500): Maximum span, 30 feet(9.1 m); minimum rod size, 1-1/4 inches(32 mm).
- F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4(DN 20): Maximum span, 5 feet(1.5 m); minimum rod size, 1/4 inch(6.4 mm).
 2. NPS 1(DN 25): Maximum span, 6 feet(1.8 m); minimum rod size, 1/4 inch(6.4 mm).
 3. NPS 1-1/2(DN 40): Maximum span, 8 feet(2.4 m); minimum rod size, 3/8 inch(10 mm).
 4. NPS 2(DN 50): Maximum span, 8 feet(2.4 m); minimum rod size, 3/8 inch(10 mm).
 5. NPS 2-1/2(DN 65): Maximum span, 9 feet(2.7 m); minimum rod size, 3/8 inch(10 mm).
 6. NPS 3(DN 80): Maximum span, 10 feet(3 m); minimum rod size, 3/8 inch(10 mm).
- G. Support vertical runs at roof, at each floor, and at 10-foot(3-m) intervals between floors.
- H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 2 (DN 50) and Smaller: 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
- I. Install supports for vertical PVC piping every 48 inches(1200 mm).

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only.
- C. Install flexible connectors at inlet and discharge connections to base mounted pumps and other vibration-producing equipment.
 - 1. In lieu of flexible connectors, three flexible mechanical grooved couplings in accordance with manufacturer's recommendations will be allowed.
- D. Install flexible hose connectors at inlet and discharge connections to ceiling mounted coil connections.
- E. Install pipe cover system where indicated in accordance with manufacturer's requirements. Paint cover to match surrounding area. Coordinate with Architect.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install ports for test plugs and pressure gages at pumps and elsewhere as indicated according to Division 23 Section "Meters and Gages for HVAC Piping."

- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections and elsewhere as indicated according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 PIPE FLUSHING AND CLEANING

- A. Thoroughly flush all new piping with system water, by passing coils. Open system drains and strainer blowdowns to remove debris. Clean all new strainers. Refill system.
- B. Fill new piping with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Perform an analysis of system water to determine if chemical treatment needed to keep system free of scale, corrosion, and fouling, is required.

3.9 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the water characteristics as required by water-treatment specialist.
- B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Add initial chemical treatment and maintain water quality as required by water-treatment specialist for the first year of operation.

3.10 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.

3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and bleed air completely.
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment to specified values.
 7. Verify lubrication of motors and bearings.

END OF SECTION 23 2113

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Close-coupled, in-line centrifugal pumps.

B. Related Sections include the following:

1. Division 23 Section "Common Work Results for HVAC" for general installation requirements and concrete equipment bases.
2. Division 23 Section "Common Motor Requirements for HVAC Equipment" for general motor requirements and shaft grounding rings.
3. Division 23 Section "Meters and Gages for HVAC Piping" for pressure gauges requirements at pumps.
4. Division 23 Section "Instrumentation and Controls for HVAC" for field installed variable frequency drives for pump motors.

1.2 DEFINITIONS

A. Buna-N: Nitrile rubber.

1.3 ACTION SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

1. No pump shall be submitted whose impeller diameter exceeds 90% of the maximum published impeller diameter for the pump, nor an impeller which is less than 15% larger than the smallest published impeller diameter for the pump.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Alignment Certificate: Include signed certificate verifying based mounted pump alignment procedures have been completed.

B. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Bell & Gossett.
 - 2. Armstrong Pumps Inc.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Basis of Design: Bell & Gossett Series e80.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig(1204-kPa) minimum working pressure and a continuous water temperature of 225 deg F(107 deg C).
- C. Pump Construction:

1. Casing: Cast iron, with threaded gage tapings at inlet and outlet, and flange connections.
 2. Impeller: Stainless steel; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
 3. Pump Shaft: Solid alloy steel, with non-ferrous shaft sleeve.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 5. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
- D. Motor: Single speed, with grease-lubricated ball bearings; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Trim pump impellers as required to have pump discharge balancing valves no more than 50% closed.

3.2 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
 1. Alignment procedure to be witnessed by Engineer or Owner representative with witness signing the alignment certificate.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install pressure gage across pump suction and discharge. Install single gage with metal tubing and multiple input selector valves.
- F. Install electrical connections for power, controls, and devices.
- G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 SHAFT GROUNDING RING INSTALLATION

- A. Factory install at each three phase motor utilizing a variable frequency controller, a shaft grounding ring. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

3.5 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.
 - 4. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 5. Start motor.
 - 6. Open discharge valve slowly.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 2123

SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes HVAC water-treatment for the following systems:
 - 1. Heating hot-water and chilled water

1.2 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Other Informational Submittals:
 - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality.
 - 2. Water Analysis: Illustrate water quality available at Project site.
 - 3. Submit a written report of each system capacity in gallons as recorded from makeup water meter.
 - 4. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Architect.

1.4 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

1.5 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Service Providers: Subject to compliance with requirements, HVAC water-treatment service provider offering products and services that may be incorporated into the Work include, but are not limited to, the following:
1. Enerco Corporation.
 2. HV Burton

2.2 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing solutions to maintain performance requirements for each required characteristic.
- B. Sample Cooler:
1. Tube: Sample.
 - a. Size: NPS 1/4(DN 8) tubing.
 - b. Material: ASTM A 666, Type 316 stainless steel.
 - c. Pressure Rating: Minimum 2000 psig(13 790 kPa).
 - d. Temperature Rating: Minimum 850 deg F(454 deg C).
 2. Shell: Cooling water.
 - a. Material: ASTM A 666, Type 304 stainless steel.
 - b. Pressure Rating: Minimum 250 psig(1725 kPa).
 - c. Temperature Rating: Minimum 450 deg F(232 deg C).
- C. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.

2.3 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality requirements.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 CLEANING AND TREATMENT OF HYDRONIC SYSTEMS

- A. General: Isolate all new piping to be cleaned from existing piping and new equipment. Provide shut-off valves and temporary bypasses as required to maintain circulation through new piping. After cleaning, remove temporary bypasses and open shutoff valves to established circulation through entire system for the water treatment application.
- B. Pre-Cleaning: Thoroughly flush all new piping with fresh water. Determine loop capacity in gallons using electric contact head type bronze constructed water meter. Fill system from completely dry to full, including air bleed out. Submit written report of system capacity in gallons taken from water meter. Drain system completely. Open drip legs and other non-flow piping to remove debris. Remove and clean all strainers.
- C. Cleaning of Non-Glycol Systems: Refill system with fresh water along with alkaline detergent cleaner. Feed cleaner through bypass feeder at recommended use rates. Circulate 8 to 72 hours. Flush system. Open, clean, and inspect all strainers, drip legs, and non-flow areas. Refill with fresh water, bleed air from system, and allow system to make-up fresh water and bleed air until water leaving system is of same quality as make-up water.
- D. Treatment of Non-Glycol Systems: Immediately introduce corrosion inhibitor through bypass feeder to protect the clean system.
- E. Sectional Cleaning: If entire system is not cleaned and treated at one time, each untreated section shall be isolated from treated sections. Untreated sections to be cleaned and treated as described above **before** connection to a previously treated section. Provide written report for each individual section.
- F. For non-glycol systems, perform tests determining analysis of supply water solution and submit written test results.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - a. Test equipment (coils, heat exchangers, control valves, strainers, etc.) to verify water flow through equipment is not reduced due to debris caused by flushing and cleaning activities.
 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 7. Cap and subject piping to static water pressure of 50 psig(345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- D. Remove and replace malfunctioning components and retest as specified above.
- E. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to maintain performance requirements for each required characteristic. Sample boiler water at four -week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.
- F. At four -week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to maintain performance requirements for each required characteristic.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 2500

SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal ducts for air-distribution systems.
- B. Related Sections include the following:
 - 1. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors, turning vanes, flexible ducts, and flexible connectors.

1.2 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect/Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.3 ACTION SUBMITTALS

- A. Product data for the following items:
 - 1. Sealing Materials.
 - 2. Duct Liner.
- B. Duct Leakage Reports: Submit duct leakage test reports. The reports shall be certified proof that the systems have been leak tested, in accordance with this specification section and the referenced standards and are an accurate representation of the system leakage.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.6 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver sealant materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90(Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch(6-mm) minimum diameter for lengths 36 inches(900 mm) or less; 3/8-inch(10-mm) minimum diameter for lengths longer than 36 inches(900 mm).
- E. Bird Screen: 1/2 inch mesh, 16 gage galvanized wire.

2.3 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
 - 1. Manufacturers:
 - a. CertainTeed Corp.; Insulation Group.
 - b. Johns Manville International, Inc.
 - c. Knauf Fiber Glass GmbH.
 - d. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
 - a. Thickness: 1 inch(25 mm).
 - b. Thermal Conductivity (k-Value): 0.26 at 75 deg F(0.037 at 24 deg C) mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 1) For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - e. Mechanical Fasteners: Galvanized steel suitable for mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb-(23-kg-) tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch(3 mm) into airstream.

2.4 SEALANT MATERIALS

- A. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
 1. For indoor applications, use adhesive that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- C. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches(100 mm) thick.
 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches(100 mm) thick.
- B. Install structural steel members between building structure members as required for upper attachment of hangers and supports. Use members of size and strength required for span and load. The use of joist or truss bridging for hanging and supporting is prohibited.
- C. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches(480 mm) and larger and 0.0359 inch(0.9 mm) thick or less, with more than 10 sq. ft.(0.93 sq. m) of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. All sizes shown on the drawings for ducts which require duct liner shall be sizes inside the liner.
- B. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- C. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- D. Butt transverse joints without gaps and coat joint with adhesive.
- E. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- F. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- G. Secure liner with mechanical fasteners 4 inches(100 mm) from corners and at intervals not exceeding 12 inches(300 mm) transversely; at 3 inches(75 mm) from transverse joints and at intervals not exceeding 18 inches(450 mm) longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
 2. Intervals of lined duct preceding unlined duct.
 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.
- I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Spiral Duct Manufacturers:

1. Allied Mechanical Services.
2. Eastern Sheet Metal.
3. LaPine Metal Products.
4. McGill AirFlow Corporation.
5. SEMCO Incorporated.
6. Universal Spiral Air.
7. Zinger Sheet Metal.

B. Round, Longitudinal-Seam Ducts: Fabricate 12 inch (305 mm) and smaller ducts and drops to diffusers of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Round, Spiral Lock-Seam Ducts: Fabricate 13 inch (330 mm) and larger ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Fabricate ducts larger than 72 inches(1830 mm) in diameter with butt-welded longitudinal seams.

D. Duct Joints:

1. Ducts up to 20 Inches(500 mm) in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches(535 to 1830 mm) in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches(1830 mm) in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

2. Round Mitered Elbows: Welded construction with metal thickness equal to or greater than that of ducts.
3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
4. Round Elbows 8 Inches(200 mm) and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30 and 60 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows 9 through 14 Inches(225 through 355 mm) in Diameter: Fabricate with gored construction, unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows Larger Than 14 Inches(355 mm) in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
7. Die-Formed Elbows for Sizes through 8 Inches(200 mm) in Diameter and All Pressures 0.040 inch(1.0 mm) thick with 2-piece welded construction.
8. Round Gored-Elbow Metal Thickness: Same as metal thickness or greater than that of ducts.

PART 3 - EXECUTION

3.1 DUCTWORK CONSTRUCTION

- A. Provide ductwork constructed in accordance with SMACNA Duct Construction Standards but no less than the static pressure classification as indicated below. Fabricate ductwork that will have less leakage than the percentage of system design air flow as indicated below. Test all ductwork for leakage, unless otherwise noted, in accordance with SMACNA HVAC Air Duct Leakage Test Manual and the following.

1. Supply Air Ductwork
 - a. Duct Construction Static Pressure Class: +3-inch wg (750 Pa).
 - b. SMACNA Seal Class: B.
 - c. Testing Static Pressure: +3-inch wg (750 Pa).
2. Return Air Ductwork
 - a. Duct Construction Static Pressure Class: -3-inch wg (750 Pa).
 - b. SMACNA Seal Class: B.
 - c. Testing Static Pressure: -3-inch wg (750 Pa).
3. Outside Air Ductwork
 - a. Duct Construction Static Pressure Class: -1-inch wg (250 Pa).
 - b. SMACNA Seal Class: C.
 - c. Testing Static Pressure: No testing required.

3.2 DUCT APPLICATIONS

- A. All ducts shall be galvanized steel.

3.3 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet(3.7 m) unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches(300 mm), with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch(25 mm), plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire dampers, fire smoke dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches(38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."
- O. Paint interiors of metal ducts, that do not have duct liner, for 24 inches(600 mm) upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.
- P. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system. Install duct mounted control dampers supplied by Temperature Control Installer.

- Q. At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.
- R. Where indicated, install wire mesh bird screen grilles mounted in a removable frame.

3.4 DUCT CLEANLINESS REQUIREMENTS

- A. Protect duct interiors from the elements and foreign materials in accordance with the following SMACNA's "Duct Cleanliness for New Construction." Guidelines:
 - 1. Basic Level.
 - 2. Intermediate Level.
 - 3. Advance Level.

3.5 SEAM AND JOINT SEALING

- A. All ductwork shall be suitably cleaned and prepared, and sealant applied in strict accordance with manufacturer's instructions. Manufacturer's recommendations for cure time shall be followed before pressure testing is begun. Any additional paint or coatings must conform to manufacturer's specifications. Seal duct seams and joints as follows:
 - 1. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations (SMACNA Seal Class A).
 - 2. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams (SMACNA Seal Class B).
 - 3. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only (SMACNA Seal Class C).
- B. Seal ducts and leak test where indicated before external insulation is applied.

3.6 HANGING AND SUPPORTING

- A. Support ductwork with support systems indicated in SMACNA "HVAC Duct Construction Standards".
- B. Support horizontal ducts within 24 inches(600 mm) of each elbow and within 48 inches(1200 mm) of each branch intersection.
- C. Support vertical ducts at maximum intervals of 16 feet(5 m) and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches(100 mm) thick.

3.7 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
- C. Louver Plenums: Fabricate of heavy gauge sheet metal material in compliance with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
 - 1. Fabricate with sloped bottom surface.
 - 2. Apply two coats of fire retardant, bitumastic waterproofing material to interior surfaces of bottom and lower half of sides.

3.8 FIELD QUALITY CONTROL

- A. Provide duct leakage testing in accordance with SMACNA HVAC Air/Duct Leakage Test Manual and prepare test reports.
- B. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.
- C. Conduct tests, in the presence of the Architect/Engineer, at static pressures equal to the maximum design pressure of the system or the section being tested. If pressure classifications are not indicated, test entire system at the maximum system design pressure. Do not pressurize systems above the maximum design operating pressure. Give 3 days' advanced notice for testing.
- D. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.
- E. Seal and leak test externally insulated ducts prior to insulation installation.
- F. Provide Leakage Testing on ductwork located in inaccessible locations (underslab, in walls and chases, etc.) before final covering is performed.

END OF SECTION 23 3113

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SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Flange connectors.
3. Turning vanes.
4. Flexible connectors.
5. Flexible ducts.

B. Related Sections:

1. Division 23 Section "Instrumentation and Control for HVAC" for motorized control dampers and damper actuators.
2. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90(Z275).
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2D finish for concealed applications and No. 4 for exposed applications.
- D. Aluminum Sheets: Comply with ASTM B 209(ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 221(ASTM B 221M), Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch(6-mm) minimum diameter for lengths 36 inches(900 mm) or less; 3/8-inch(10-mm) minimum diameter for lengths longer than 36 inches(900 mm).

2.2 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. Greenheck.
 - e. McGill AirFlow LLC.
 - f. METALAIRE, Inc.
 - g. Nailor Industries Inc.
 - h. Pottorff.
 - i. Ruskin Company.
 - j. Trox USA Inc.
 - k. Vent Products Company, Inc.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch(1.62-mm) minimum thickness.

- b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
- a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch(1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
- a. Oil-impregnated bronze or molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg(750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.
- B. Damper Hardware:
- 1. Locking manual quadrant calibrated to show damper position.
 - 2. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-(2.4-mm-) thick zinc-plated steel, and a 3/4-inch(19-mm) hexagon locking nut.
 - 3. Include center hole to suit damper operating-rod size.
 - 4. Include elevated platform for insulated duct mounting.

2.3 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.4 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.

5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches(1200 mm) wide and double wall for larger dimensions.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Ductmate Industries, Inc.
- 2. Duro Dyne Inc.
- 3. Ventfabrics, Inc.
- 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches(89 mm) wide attached to 2 strips of 2-3/4-inch-(70-mm-) wide, 0.028-inch-(0.7-mm-) thick, galvanized sheet steel or 0.032-inch-(0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

- 1. Minimum Weight: 26 oz./sq. yd.(880 g/sq. m).
- 2. Tensile Strength: 480 lbf/inch(84 N/mm) in the warp and 360 lbf/inch(63 N/mm) in the filling.
- 3. Service Temperature: Minus 40 to plus 200 deg F(Minus 40 to plus 93 deg C).

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

- 1. Minimum Weight: 24 oz./sq. yd.(810 g/sq. m).
- 2. Tensile Strength: 530 lbf/inch(93 N/mm) in the warp and 440 lbf/inch(77 N/mm) in the filling.
- 3. Service Temperature: Minus 50 to plus 250 deg F(Minus 45 to plus 121 deg C).

2.6 FLEXIBLE DUCTS

A. Insulated, Flexible Duct (Type F-1): UL 181, Class 1, acoustically rated, woven fiberglass fabric with flame resistant coated core supported by helically wound, spring-steel wire; fibrous-glass insulation (R-4.2); bi-directional reinforced metallized vapor-barrier film.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Themaflex Model M-KC or comparable product by the following:

- a. Flexmaster U.S.A., Inc.
 2. Positive Pressure Rating: 16-inch wg(4000 Pa) positive for sizes 4 to 10 Inches(100 to 250 mm), 10-inch wg(2500 Pa) positive for sizes 12 to 16 Inches(300 to 400 mm).
 3. Negative Pressure Rating: 2.0-inch wg(500 Pa) negative for sizes 4 to 16 Inches(100 to 400 mm).
 4. Maximum Air Velocity: 6000 fpm(30 m/s).
 5. Temperature Range: Minus 20 to plus 250 deg F(Minus 29 to plus 1221 deg C).
 6. Insulation R-value: R-4.2
- B. Flexible Duct Connectors:
 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches(75 through 460 mm), to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of galvanized-steel materials in galvanized-steel ducts.
- C. Install turning vanes in all square or rectangular 90 degree elbows.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install flexible connectors to connect ducts to equipment.
- G. Install flexible ducts as follows:
 1. Install flexible ducts at accessible concealed locations only.
 2. Connect terminal units to high velocity supply ducts with maximum 18-inch(450-mm) lengths of flexible duct Type F-1, clamped or strapped in place. Flexible ducts are for alignment purposes only. Do not use flexible ducts to change directions.
 3. Connect diffusers to ducts directly or with maximum 36-inch(914.4-mm) lengths of flexible duct Type F-1, clamped or strapped in place. Flexible ducts are for alignment purposes only. Do not use flexible ducts to change directions.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**AIR DUCT ACCESSORIES
23 3300 - 6
12/21/2022**

1. Operate dampers to verify full range of movement.
2. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 3300

SECTION 23 3723 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of roof-mounting intake and relief ventilators:
 - 1. Roof hoods.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221(ASTM B 221M), Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209(ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90(Z275) zinc coating, mill phosphatized.
- D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 ROOF HOODS

- A. Manufacturers:
 - 1. Greenheck.

2. Loren Cook Company.
- B. Factory fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Galvanized-steel sheet, minimum 0.064-inch-(1.62-mm-) thick base and 0.040-inch-(1.0-mm-) thick hood; suitably reinforced.
- D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-(40-mm-) thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch(40-mm) wood nailer. Size as required to fit roof opening and ventilator base. Provide with level top and bottom to match roof slope.
 1. Configuration: Self-flashing with mounting flange.
 2. Overall Height: Refer to drawing detail.
- E. Bird Screening: Galvanized-steel, 1/2-inch-(12.7-mm-) square mesh, 0.041-inch(1.04-mm) wire.
- F. Insulation: Insulate inside bottom of ventilator roof.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure gravity ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
- E. Label gravity ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

END OF SECTION 23 3723

SECTION 23 8223 - UNIT VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit ventilators and accessories with the following heating and cooling features:
 - 1. Hydronic change over chilled water / heating coil.

1.2 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for each unit type and configuration.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Plans, elevations, sections, and details.
 - 2. Details of anchorages and attachments to structure and to supported equipment.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
 - 4. Perimeter moldings.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: Furnish one spare filter for each filter installed.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 COORDINATION

- A. Coordinate layout and installation of unit ventilators and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of wall sleeves for outdoor-air intake and relief dampers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Trane.
 - 2. Daikin/McQuay.
 - 3. JCI.

2.2 MANUFACTURED UNITS

- A. Description: Factory-packaged and -tested units rated according to ARI 840, ASHRAE 33, and UL 1995, including finished cabinet, filter, chilled water / heating hot water coil, drain pan and supply air fan and motor.

2.3 CABINETS

- A. Insulation: Foil-covered or matte-finish, complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
 - 1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
 - 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

- B. Drain Pans: Plastic or insulated galvanized steel with plastic liner, formed as required by ASHRAE 62.1.
- C. Cabinet Frame and Access Panels: Welded-steel frame with removable panels fastened with hex-head tamperproof fasteners and key-operated control and valve access doors.
 - 1. Steel components exposed to moisture shall be hot-dip galvanized after fabrication.
 - 2. Include safety chain on ceiling mounted units.
- D. Cabinet Finish: Baked enamel, in manufacturer's standard paint color as selected by Architect.
- E. Outdoor-Air Inlet: Duct collar. See equipment schedule.
- F. Supply-Air Outlet: Duct collar. See equipment schedule.
- G. Return-Air Inlet: Punched louver. See equipment schedule.
- H. Electrical Connection: Factory wire motors and controls with disconnect switch for a single electrical connection.

2.4 COILS

- A. Test and rate unit ventilator coils according to ASHRAE 33.
- B. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch(2.5 mm), rated for a minimum working pressure of 200 psig(1378 kPa) and a maximum entering-water temperature of 220 deg F(104 deg C). Include manual air vent and drain valve.

2.5 INDOOR FAN

- A. Fan and Motor Board: Removable.
 - 1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels; and aluminum, painted-steel, or galvanized-steel fan scrolls.
 - 2. Fan Shaft and Bearings: Hollow steel shaft with permanently lubricated, resiliently mounted bearings.
 - 3. Motor: ECM. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 4. Wiring Termination: Connect motor to chassis wiring with plug connection.
 - 5. Basic Motor Controls:
 - a. Fan-speed.

2.6 DAMPERS

- A. Mixing Dampers: Galvanized-steel blades with edge and end seals and nylon bearings.
- B. Comply with ASHRAE/IESNA 90.1.

2.7 ACCESSORIES

- A. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
 - 1. Pleated Cotton-Polyester Media: 90 percent arrestance and 13 MERV.

2.8 BASIC UNIT CONTROLS

- A. Basic Unit Controls:
 - 1. Provide unit "DDC controls ready" for field furnished and installed controls by controls Installer.
 - 2. Unit-mounted with the following features:
 - a. Control voltage transformer.
 - b. Fan on-auto switch.
 - c. Fan speed control.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive unit ventilators for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit ventilator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install unit ventilators to comply with NFPA 90A.
- B. Suspend horizontal unit ventilators from structure with threaded steel rods and minimum 1.0-inch(25-mm) static-deflection spring hangers.
- C. Verify location of exposed control sensors with Drawings and room details before installation. Install devices to match light switch heights.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - 1. Install piping adjacent to machine to allow service and maintenance.
 - 2. Connect to condensate drain pans and extend to condensate pump and then to condensate piping. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

- B. Install piping adjacent to unit to allow service and maintenance.
- C. Connect supply ducts to unit ventilators with flexible duct connectors specified in Division 23 Section "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain unit ventilators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 8223

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SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical Scope of work
 - 2. Electrical equipment coordination and installation.
 - 3. Rough-in
 - 4. Electrical Demolition
 - 5. Common electrical installation requirements.

1.3 SCOPE OF WORK

- A. The scope of work is to include but not be limited to the following:
 - 1. Obtain all required electrical construction permits and inspections.
 - 2. Provide a 277/480 volt, 3 phase, 4 wire, distribution system for lighting and HVAC equipment.
 - 3. Provide a 120/208 volt, 3 phase, 4 wire, distribution system for convenience receptacles, small appliances and small motors.
 - 4. **Refer to mechanical drawings. Provide low voltage raceways (1/2" minimum) for all thermostats, controls and low voltage systems. No low voltage wiring of any type shall be visible in exposed ceiling areas.**
 - 5. Provide complete electrical installation including all components, i.e. light fixtures, lamps, receptacles, conduit, wire, etc.
 - 6. Tie in to existing fire alarm system.
 - 7. Provide raceway system for sound system, clock/program system, and security system.
 - 8. Provide raceway system for telephone/data networking systems.
 - 9. Provide for Owner training by factory representatives in operation and maintenance of systems where specified.
 - 10. Provide selective demolition of electrical systems and equipment as indicated on the drawings.
 - 11. Submit documentation such as shop drawings, record documents, maintenance manuals, infrared scan results, systems test results, fire alarm system certification, etc. as specified.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate electrical systems, equipment and materials installation with other building components.
- C. Coordinate installation of electrical panelboard tubs, backboxes and concealed conduit and tubing with masonry/concrete work.
- D. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
- E. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- G. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

1.5 INTERPRETATIONS

- A. It is the intent of these Drawings and Specifications to result in a complete electrical installation in complete accordance with applicable code and ordinances.
- B. Drawings are diagrammatic in character and do not necessarily indicate every required junction box, pull box, ell, etc. Items not specifically mentioned in the specification or noted on the Drawings, but which are necessary to make a complete working installation, shall be included.
- C. Drawings and Specifications are complementary. Whatever is called for in either is binding as though called for in both. The more stringent requirement shall govern.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION

- A. Disconnect, demolish, and remove electrical system equipment and components indicated to be removed.

- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Inaccessible Work: Cut and remove buried raceway and wiring, indicated to be demolished, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. All existing fixtures, equipment, etc., that are removed and not indicated to be relocated, or reused, shall first be offered to the Owner, after Owner has approved, the remaining removed items shall become property of the Contractor and shall be removed from the building site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
- F. Protect existing electrical equipment and installations not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- G. Contractor shall examine the Drawings and Specifications, and existing conditions. All costs relating to maintaining existing services or relocating existing circuits and/or equipment shall be included in the bid. Contractor is required to complete all work necessary to meet these requirements without additional expense to the Owner or his Representative.
- H. Equipment Replacement: Contractor shall verify all circuit breakers and fuse sizes against the existing wire size prior to replacing switchboards, panelboards and disconnect switches. Notify the Architect of any discrepancies prior replacing equipment.

3.2 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 49 for rough-in requirements.

3.3 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- B. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
- C. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- D. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- E. Measure indicated mounting heights to bottom of unit for suspended items and to bottom of unit for wall-mounting items or as indicated on drawings.

- F. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- H. Right of Way: Give to piping systems installed at a required slope.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 0500

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.3 CLOSEOUT SUBMITTALS

- A. Dated documentation of torque values of cable connections on all equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Conductor Material: Copper complying with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation Types: Type THHN-2, THWN-2, Type XHHW-2, Type RHW2 and Type SO

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Minimum conductor size for power wiring #12 AWG.
- B. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway.
- C. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- E. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- F. Emergency Power Feeder: Provide UL 2196 listed electrical circuit protective system with a minimum 2-hour fire rating such as RHW2 or Draka "Lifeline MC". This includes all legally required, life safety ATS's, panels, branch panels. Routing the feeder in a non-sprinkled ceiling space of a sprinkled building does not negate the need for this requirement. Alternatively to RHW2, feeder can be routed underground into 2-hour rated room or routed in 2 hour rated soffit.
- G. Emergency Power Branch Circuits: Other than NFPA 130 applications, provide 2-hour rated cables as indicated above.
- H. Exposed Branch Circuits, including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- I. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- J. Fixture Whips: Type MC cable may be used for light fixture whips only, with a maximum length of 6 feet.
- K. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-2-THWN-2, single conductors in raceway.
- L. Underground Feeders and Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.
- M. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- N. Fire Alarm Circuits: UL2196 rated cabling in raceway or Power-limited, fire-protective, signaling circuit cable where raceway is not specified.
- O. Class 1 Control Circuits: Type THHN-2-THWN-2, in raceway.
- P. Class 2 Control Circuits: Type THHN-2-THWN-2, in raceway or Power-limited cable, concealed in building finishes where raceway is not specified.

- Q. Dimming Control Circuits: Provide 600V rated cabling for 0-10V dimming circuits. Wiring to be installed in conduit where exposed. Install in accordance with the proper class 1 or class 2 circuit requirements as required by the lighting control system used.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Where 120 volt, 20 amp, branch circuit wiring from panelboard to first outlet exceeds 100 feet in length, increase home-run wire size to #10 AWG.
- B. Where 277 volt, 20 amp, branch circuit wiring from panelboard to first light fixture exceeds 150 feet in length, increase home-run wire size to #10 AWG.
- C. Common neutral conductors **shall not** be used for convenience outlet or lighting branch circuits.
- D. Neutral conductors shall be clearly labeled at the panelboard with the circuit number of associated phase conductors.
- E. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- F. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- H. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- I. Support cables according to Division 26 Section "Common Work Results for Electrical."
- J. Seal around cables penetrating fire-rated elements according to Division 07 Section "Penetration Firestopping."
- K. Cable tie tightness where applicable shall be per NECA and UL standards, do not over tighten.
- L. One-hour and Two-hour cables should be installed using components specified in appropriate FHIT document and Manufacturer Installation guide. Substitutions are not permitted.

3.3 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches(300 mm) of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.
- C. Comply with IEEE837 – Standard for qualifying permanent connections used in Substation Grounding

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Copperweld Corp.
 - b. Erico Inc.; Electrical Products Corporation.
 - c. FCI Burndy Products.
 - d. Ideal Industries, Inc.
 - e. ILSCO.
 - f. Kearney/Cooper Power Systems.
 - g. O-Z/Gedney Co.; a business of the EGS Electrical Group.
 - h. Raco, Inc.; Division of Hubbell.
 - i. Thomas & Betts, A Member of the ABB Group.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare stranded unless otherwise indicated.
- F. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch(6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches(41 mm) wide and 1/16 inch(1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches(41 mm) wide and 1/16 inch(1.6 mm) thick.
- G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Compression Connectors: Irreversible hydraulic compression kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- E. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long barrel, two-bolt connection to ground bus bar

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel.

1. Size: $\frac{3}{4}$ inch in diameter by 120 inches long.
- B. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded or Irreversible Compression Connections: Use for connections to structural steel and for underground connections.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Install equipment grounding conductors or grounding electrode conductors that are routed through exposed ceiling spaces in conduit.
- F. Label equipment grounding conductors and grounding electrode conductors as indicated in "Identification for Electrical Systems".
- G. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- H. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- I. Grounding Bus: Install in electrical service equipment rooms.
 1. Size: 1/4 inch by 2 inches bare, annealed copper.
 2. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
 3. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- J. Underground Grounding Conductors: Use tinned-copper conductor, No. 2/0 AWG minimum unless noted otherwise. Bury at least 24 inches (600 mm) below grade.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.

3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
1. Drive ground rods until tops are 6 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.
 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
 - 4. Bond all steel structure and concrete reinforcement steel / rebar.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Concrete-Encased Electrodes: Connect grounding conductor to the foundation reinforcing bars or rods and bond the bars together with steel tie wires.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding Variable-Frequency Motors: Provide copper braided grounding strap between motor and metallic conduit (EMT or IMC) in addition of the equipment grounding conductor on motors controlled with a variable-frequency controller.

3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.
- B. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

3.6 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.
 - 5. Manhole Ground: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 0526

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SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.

- e. Thomas & Betts Corporation/ A Member of the ABB Group.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch(6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to trapeze member with clamps approved for application.
 2. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Provide independent support rings/shepherd hooks for any low voltage communications systems cabling. Cabling shall not rest on ceiling and shall be organized neatly on hooks. Cable shall not be visible in exposed ceiling spaces.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 for installation requirements, except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb(90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches(100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches(100 mm) thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.
- D. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.
- B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- C. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 3000 "Cast-in-Place Concrete."

- D. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils(0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 0529

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SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, hand holes and attachment details.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC and EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

- F. Fittings for LFNC: Comply with UL 514B.

2.3 PVC COATED RIGID METAL CONDUIT

- A. The PVC coated rigid metal conduit shall be hot dip galvanized inside and out. The interior galvanizing shall be listed per UL 6. The exterior galvanizing shall be listed per UL 6 as primary corrosion protection. Thread protectors shall be used on the exposed threads of the PVC coated conduit. PVC coated RMC steel conduit shall comply with UL 6, ANSI C80.1, and NEMA RN-1 standards without exception.
- B. The PVC coating, in compliance with NEMA RN-1, shall be nominal 40 mils in thickness continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles or pin- holes. PVC shall be UL listed as a primary corrosion protection.
- C. A urethane coating shall be uniformly and consistently applied to the interior of conduit. This internal coating shall be a nominal 2 mils thickness. All male threads on elbows and nipples shall be zinc coated using zinc rich paint.
- D. Coated couplings shall be used with coated conduit. The thickness of the coating on couplings shall be at least equal to the thickness of the coating on the conduit. Each coated coupling shall have a flexible PVC sleeve which extends from each end of the coupling and which will overlap the PVC coating on the conduit when the coupling has been installed on the conduit. The length of the sleeve extension(s) shall be at least equivalent to the nominal Trade Size for sizes 1/2" up through 1-1/2". For Trade Size 2" through 6", the length of the sleeve extension(s) shall be at least 2 inches. The PVC sleeve shall be a nominal thickness of 40 mils in thickness. The inside diameter of the overlapping sleeve shall be less than the outside diameter of the PVC-coated conduit.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R as required.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: Hinged type, Screw-cover type, Flanged-and-gasketed type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating and ivory finish coat.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation / A Member of the ABB Group.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- C. Surface Metal Raceways: Satin anodized extruded aluminum with snap-on covers.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Post Glover
 - b. Thomas & Betts Corporation / A Member of the ABB Group
 - c. Wiremold Company
- D. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture ivory color.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hellermann Tyton
 - b. Hubbell, Inc.; Wiring Device Division.
 - c. Lamson & Sessions; Carlon Electrical Products.
 - d. Mono-systems, Inc.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.
- E. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways. Provide concealed support clips or fasten raceway internally. Do not use external mounting straps.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- I. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.
- J. Telephone/Data Backboxes: Provide 2-gang, 3 ½ inch deep backboxes with single gang raised cover unless noted otherwise on plans.
- K. Low Voltage Boxes: 5-Square telecommunications outlet boxes (5 in. square x 2.875 deep w/ cable management) shall be used for all low voltage applications. 5-square box shall support 5e, 6, augmented 6, 7, and optical fiber cables. Low voltage boxes shall support integral cable management by allowing slack cable to be wound internally while maintaining minimum bend radius requirements. 5-square boxes shall also be used for all fire alarm applications.

2.8 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard gray paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

2.9 CABLE PATHWAY AND FIRESTOP DEVICE

- A. Manufacturer:
 - 1. Specified Technologies, Inc., EZ-Path fire rated pathway.
 - 2. Wiremold, FlameStopper FS Series thru-wall fitting for fire walls.
- B. Description: Through-the-wall 3" x 3" steel wiring channel or 4" EMT equipped with heat expanding intumescent fire stopping material.
- C. Wiring channel shall be provided with steel wall plates allowing for single or multiple channels to be ganged together.
- D. Wiring channel shall have an F rating equal to the rating of the barrier in which it is installed.
- E. Wiring channel shall be capable of allowing a 0 to 100 percent visual fill of cable.

- F. Wiring channel shall be tested in accordance with ASTM E 814 (ANSI/UL1479). Channel shall bear the UL classification marking.
- G. Provide the quantity of devices needed to allow a cable pass cross section capacity of 50 percent of the adjacent cable tray cross section.

2.10 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Standard: Comply with SCTE 77.
 - 2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC".
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Wall Style: Flared wall assembly.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors:
 - 1. Exposed: Rigid steel. (No RNC Allowed)
 - 2. Concealed, Aboveground: Rigid steel.
 - 3. Underground: RNC Schedule 80.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures: NEMA 250, Type 3R or 4.
- B. Indoors:
 - 1. Exposed in Unfinished Utility Spaces (mechanical rooms, electrical rooms and tunnels): EMT.
 - 2. Exposed in Finished Spaces: All conduit shall be concealed unless specifically indicated on plans.
 - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
 - 4. Concrete Floors: RNC.
 - 5. Concealed in Ceilings and Interior Walls and Partitions: EMT

6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: Rigid steel conduit.
 8. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
- C. Minimum Raceway Size: 1/2-inch trade size(16mm),.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this Article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Provide separate raceways for lighting, receptacle, and motor loads. Do not mix branch circuit wiring for these different loads in the same raceway.
- C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Support raceways as specified in Division 26 Section "Common Work Results for Electrical."
- G. Install temporary closures to prevent foreign matter from entering raceways.
- H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- K. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
 2. Conduit and EMT may be surface mounted in Mechanical and Electrical Rooms except for wiring devices, light switches, low voltage devices or any other device shall be concealed in new wall.
 3. Surface mounted conduit or EMT may be used where specifically approved by Architect/Engineer. In such situations, the conduit, fastening devices, and junction boxes shall be painted to match the adjacent surface.

- L. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (27mm) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Change from nonmetallic tubing to rigid steel conduit before rising above floor or grade.
- M. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- O. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- P. Tighten set screws of threadless fittings with suitable tools.
- Q. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
 - 3. Telephone, data and fiber optic cable conduits shall be provided with bushings on conduit ends.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- S. Color-Coding: Paint fire alarm system junction boxes and covers red.
- T. Raceways for Optical Fiber and Communications Cable: Install as follows:
 - 1. 3/4-Inch(19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet(15 m).
 - 2. 1-Inch(25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet(23 m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- U. Telephone, data, AV, security, access control, fiber optic cable system, building control cabling, lighting control, 0-10V dimming control and any other low voltage systems cabling shall be installed in conduit in

areas of exposed ceiling. In areas with accessible ceilings, the low voltage systems cables shall be neatly routed and independently supported with cable rings to the nearest cable tray, technology closet, conduit run or equipment connection. Systems to be in conduit in accessible ceiling spaces where required elsewhere in the specification or drawings.

- V. Telephone, data and fiber optic cable system conduit shall be provided with wide sweep bends.
- W. Telephone, data and fiber optic cable outlets shall be provided with a 1 inch conduit stubbed into accessible ceiling space unless noted otherwise on the drawings. Provide bushings on the ends of the conduit.
- X. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- Y. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

- AA. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
 - BB. Flexible Connections to Lighting Fixtures:
 - 1. Above ceilings that are continuous to wall: Provide flexible conduit to all recessed lighting fixtures, maximum length as indicated. For fixtures mounted on grid ceilings, provide adequate length of flexible conduit to allow relocation of fixture on grid space in any lateral direction.
 - 2. Above clouds or above suspended ceiling elements that are visible and exposed, Flexible Connections to Lighting Fixtures shall be limited to reduce sight of flexible conduit. Flexible connections to light fixtures shall not be visible from standing on the floor or nearby landings or overlooks. Minimize angle of visibility, run EMT as necessary and coordinate with trades to group systems to minimize drops. All drops to element/cloud to be EMT and shall not be flex.
 - CC. Equipment Grounding Conductor: Install a green equipment grounding conductor in all flexible conduit and non-metallic (PVC) conduit.
 - DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
 - EE. Recessed back-to-back boxes are not permitted in the same wall. Arrange boxes with at least 12 inches of horizontal spacing.
 - FF. Recessed Boxes in Masonry Walls: Saw-cut opening for box in masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
 - GG. Locate boxes so that cover or plate will not span different building finishes.
 - HH. Set floor boxes level and flush with finished floor surface.
 - II. Set floor boxes level. Trim after installation to fit flush with finished floor surface.
 - JJ. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
 - KK. Provide stainless steel cover plates on all abandoned boxes that remain from selective demolition.
 - LL. Cable pathway and firestop device: Install in locations where indicated on the plans. Arrange singly or in gangs and mounted above accessible ceilings. Install the devices in strict accordance with the manufacturer's recommendations.
- 3.3 INSTALLATION OF UNDERGROUND CONDUIT
- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches(150 mm) in nominal diameter.
 - 2. Install backfill as specified in Division 31 Section "Earth Moving."

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches(300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout length elbow.
5. Transition from PVC-Schedule 80 (RNC) to RMC underground, no RNC conduit shall exposed outdoors or inside building.
6. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches(75 mm) of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches(1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
7. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line 42" below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 0533

SECTION 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried duct banks.
 - 2. Handholes and boxes.
 - 3. Manholes.

1.2 ACTION SUBMITTALS

- A. Product Data: For accessories for manholes, handholes, and boxes.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design and manhole frame support rings.
 - 4. Ladder details.
 - 5. Grounding details.
 - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.
 - 9. Thomas & Betts; Carlon Electrical Products.
 - 10. Manhattan/CDT; a division of Cable Design Technologies.
 - 11. Spiraduct/AFC Cable Systems, Inc.
- C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- D. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
 - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, as indicated for each service.
 6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Handholes **12 inches wide by 24 inches long** and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 - e. Quazite
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- H. Direct-Buried Duct Banks:
 - 1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - 2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
 - 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
 - 4. Install backfill as specified in Division 31 Section "Earth Moving."
 - 5. Concrete Cap: Install 4" concrete cap at a depth of 30 inches below grade. Cap to extend 6" past each side of overall duct bank width.
 - 6. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill

over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

7. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
8. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
9. Set elevation of bottom of duct bank below the frost line.
10. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
11. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
12. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 0543

SECTION 26 0544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
- 2. Sleeve-seal systems.
- 3. Sleeve-seal fittings.
- 4. Grout.
- 5. Silicone sealants.

- B. Related Requirements:

- 1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. LEED Submittals:

- 1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
- 2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Exterior Wall Sleeves:

- 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 1. Material: Galvanized sheet steel.
 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 3. Pressure Plates: Carbon steel.
 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 0544

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Identification for raceways.
 2. Identification of power and control cables.
 3. Identification for conductors.
 4. Underground-line warning tape.
 5. Warning labels and signs.
 6. Instruction signs.
 7. Equipment identification labels.
 8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches(50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches(50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils(0.08 mm) thick by 1 to 2 inches(25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend, machine printed by thermal transfer or equivalent process.

2.4 NAMEPLATES AND SIGNS

- A. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch(1.6 mm) thick for signs up to 20 sq. in.(129 sq. cm) and 1/8 inch(3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
- B. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch(6.4-mm) grommets in corners for mounting.
- C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch(1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch(6.4-mm) grommets in corners for mounting.
- D. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.5 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 4. Not less than 6 inches wide by 4 mils thick(152 mm wide by 0.102 mm thick).
 5. Compounded for permanent direct-burial service.
 6. Embedded continuous metallic strip or core.
 7. Printed legend indicating type of underground line.
- B. Color and Printing:
1. Comply with ANSI Z535.1 through ANSI Z535.5.
 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 2. 1/4-inch(6.4-mm) grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches(180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch(1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch(6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches(250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES(915 MM)."

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch(10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch(10 mm).
- C. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch(25 mm).

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

- E. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- F. Circuits with More Than 600 V: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
 - 1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
 - 4. Entire surface of exposed conduits.
- G. Install painted identification according to manufacturer's written instructions and as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime surfaces using type of primer specified for surface.
 - 3. Apply one intermediate and one finish coat of enamel.
- H. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- I. Circuit Identification on Device Plates.
 - 1. Identify circuits feeding receptacles with the designation of the panelboard and the circuit number in permanent marker on the back of each device cover plate.
 - 2. In mechanical, technology closets, electrical rooms and industrial type spaces, provide typed self-adhesive plastic labeling on outside of cover-plate to indicate the circuit number.
- J. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- K. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot(15-m) maximum intervals in straight runs, and at 25-foot(7.6-m) maximum intervals in congested areas.
- L. Underground-Line Warning Tape: During backfilling of trenches, install continuous underground-line warning tape directly above line at 6 to 8 inches(150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches(400 mm) overall.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 20-foot(6-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder and branch-circuit phase conductors:
 - 1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 2. 480/277-V Conductors:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Slate/Gray.
 - e. Ground: Green.
 - 3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches(150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-(25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches(76 mm) from the terminal and spaced 3 inches(76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- D. Provide labelling of each independent, conductors at 50' maximum centers, label at equipment and label at bus bars. Separate ground conductors routed concealed within conduit shall have conduit labels to identify the grounding conductor equipment or grounding/bonding location.
 - a. Indicate what equipment is fed or where the equipment is fed from on the label.
 - b. At service grounding bus bar, label "service grounding electrode conductor" at service entrance ground and label the equipment served by each equipment ground conductor.

- E. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- F. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch-(9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-(10-mm-) high letters for emergency instructions at equipment used for power transfer, load shedding and multiple services.
- I. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-(13-mm-) high lettering on 1-1/2-inch-(38-mm-) high label; where two lines of text are required, use labels 2 inches(50 mm) high. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Electrical switchgear and switchboards.
 4. Electrical substations.
 5. Emergency system boxes and enclosures.
 6. Motor-control centers.
 7. Disconnect switches.
 8. Enclosed circuit breakers.
 9. Motor starters.
 10. Push-button stations.
 11. Boiler shut-offs.
 12. Power transfer equipment.
 13. Contactors.
 14. Remote-controlled switches.
 15. Dimmers.
 16. Control devices.
 17. Transformers.

18. Power-generating units.
19. Clock/program master equipment.
20. Call system master station.
21. Fire alarm control panel.
22. Security-monitoring master station or control panel.

END OF SECTION 26 0553

SECTION 26 0800 - COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.
 - 2. Division 22 Section "Commissioning of Plumbing" for plumbing commissioning requirements.
 - 3. Division 23 Section "Commissioning of HVAC" for HVAC commissioning requirements.

1.2 ABBREVIATIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for list of abbreviations used in the Specifications and in the Commissioning Plan.

1.3 DEFINITIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for list of definitions used in the Specifications and in the Commissioning Plan.

1.4 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

1.5 COMMISSIONING PROCESS

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to the commissioning process.

1.6 COMMISSIONING TEAM RESPONSIBILITIES

- A. Provide information requested by the CxA for final commissioning documentation.
 - 1. Test reports
- B. Assist the CxA in all verification and functional performance tests.
- C. Refer to Division 01 Section "General Commissioning Requirements" for additional requirements pertaining to the contractor responsibilities.

1.7 SYSTEMS TO BE COMMISSIONED

- A. Any electrical equipment or systems that are monitored and or controlled by Building Management System will be commissioned with no sampling methods.
- B. Refer to Division 01 Section "General Commissioning Requirements" for electrical systems to be commissioned.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Refer to Division 01 Section "General Commissioning Requirements" for test equipment requirements.

PART 3 - EXECUTION

3.1 MEETINGS

- A. Refer to Division 01 Section "General Commissioning Requirements" for meeting requirements.

3.2 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. No commissioning checklists will be required to be completed by Electrical contractor.
- B. Refer to Division 01 Section "General Commissioning Requirements" for additional participation requirements for start-up, prefuctional checklists and initial checkout.

3.3 FUNCTIONAL PERFORMANCE TESTING

- A. Sampling: No sampling of any equipment will be permitted. All equipped or types referenced in Division 01 Section "General Commissioning Requirements" will be 100% sample rate regardless of qty or size of equipment or system.
- B. Refer to Division 01 Section "General Commissioning Requirements" for additional participation requirements for functional performance testing.

3.4 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Refer to Division 01 Section "General Commissioning Requirements" for approval procedures.

3.5 DEFERRED TESTING

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deferred testing.

3.6 WRITTEN WORK PRODUCTS

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to written work products related to the commissioning process.

END OF SECTION 26 0800

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SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Photoelectric switches.
2. Indoor occupancy switchbox-mounted occupancy and outdoor motion sensors.
3. Emergency lighting devices.

B. Related Requirements:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data

1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Douglas Lighting Controls
2. Intermatic, Inc.
3. Lighting Control and Design.

4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc(16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc(16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.2 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Douglas Lighting Controls
2. Hubbell Lighting.
3. Leviton Mfg. Company Inc.
4. Lighting Control and Design.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. Novitas, Inc.
7. Sensor Switch, Inc.
8. TORK.
9. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
5. Sensors shall be rated for their environment. Sensors installed in damp environment not limited to shower rooms, locker rooms, outdoor areas, shall be provided with high humidity option. High humidity option shall be available by the manufacturer when required.
6. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch(13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
8. Bypass Switch: Override the on function in case of sensor failure.
9. Automatic Light-Level Sensor: Adjustable from 10 to 300 fc(21.5 to 2152 lx); keep lighting off when selected lighting level is present.

C. Dual Technology Type: Ceiling mounting; detect occupancy by sensing a combination of passive infrared heat and ultrasonic technologies in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch-(150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.(232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft.(93 sq. m) when mounted on a 96-inch-(2440-mm-) high ceiling.

2.3 SWITCH-BOX OCCUPANCY SENSORS

A. Manufacturers:

1. Douglas Lighting Controls
2. Hubbell Lighting Inc.
3. Leviton Mfg. Company Inc.
4. Lighting Control and Design.
5. MYTECH Corporation.
6. Novitas, Inc.
7. Sensor Switch, Inc.
8. TORK.
9. Watt Stopper (The).

B. Description: PIR type with integral power-switching contacts rated for 800 W at 120-V ac, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, or 1/6-hp motors; and rated for 1000 W at 277-V ac, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, or 1/3-hp motors, minimum.

1. Sensor shall cover 1000 square feet for major motion and 300 square feet for minor motion.

2. Sensor shall have an audible warning that beeps before lights turn off automatically. This feature shall have the option of being disabled.
3. Include ground wire.
4. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.
5. Sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.

2.4 DIGITAL OCCUPANCY SENSORS AND DIMMERS

A. Manufacturers:

1. nLIGHT by Sensor Switch, An Acuity Brands Company.
2. Wattstopper.

B. Digital System Occupancy Sensors

1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. All Sensors must be programmed for Vacancy Sensor operation for all rooms except for corridors and restrooms. Corridors and restrooms shall have the occupancy sensor turn the lights on when human activity is detected. The Digital Switch must be pressed for lighting to turn ON, and OFF. The sensor is for Automatic OFF ONLY.
3. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
4. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
5. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
6. All sensing technologies shall be acoustically passive meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
7. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120 / 277 / 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor. Relays shall be dry contacts.
8. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
9. Sensors shall be available in multiple lens options which are customized for specific applications.
10. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
11. All sensors shall have two RJ-45 ports.

12. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
13. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
14. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
15. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
16. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
17. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
18. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
19. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)
20. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified. See Drawings for Details and Part Numbers.
21. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
22. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
23. Sensors with dimming can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of Class 2 current (typically 40 or more ballasts).
24. Sensors shall be the following Sensor Switch model numbers, with device options as specified: See Drawings for Details and Part Numbers.

C. Digital System Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2nd relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass
7. through chase nipple into adjacent junction box without any exposure of wire leads.
8. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all load types, and be rated for 400,000 cycles.
9. Specific Secondary Packs shall be available that provide up to 5 Amps of switching as well as 0-10 VDC dimming of fluorescent ballasts.

10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
11. Specific Secondary Packs shall be available that provide up to 5 Amps of switching of dual phase (208/240/480 VAC) lighting loads.
12. Specific Secondary Packs shall be available that require a manual switch signal (via a networked Wall Station) in order to close its relay.
13. When Required Specific Emergency Secondary Power Packs shall be available to provide switching up to 5 Amps at 120 or 277v and must hold a UL924 Listing.
14. Provide auxiliary relay for connection to building management system.
15. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers: See Drawings for Details and Part Numbers.

D. Digital System Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Devices shall be available with zero or one integrated Class 1 switching relay.
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. All sensors shall have two RJ-45 ports.
5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
6. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
7. Devices with dimming control outputs can control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of current (typically 40 or more ballasts).
8. Devices with capacitive touch buttons shall provide audible user feedback with different sounds for on/off, raise/lower, start-up, and communication offline.
9. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
10. Devices with mechanical push-buttons shall be made available with custom button labeling
11. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
12. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified: See Drawings for Details and Part Numbers.

2.5 OUTDOOR MOTION SENSORS (PIR)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Bryant Electric; a Hubbell Company.
 2. Hubbell Lighting.
 3. Lighting Control and Design.
 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 5. Paragon Electric Co.; Invensys Climate Controls.

6. TORK.
 7. Watt Stopper (The).
- D. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.
1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
 - b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 3. Bypass Switch: Override the on function in case of sensor failure.
 4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc(11 to 215 lx); keep lighting off during daylight hours.
- E. Detector Sensitivity: Detect occurrences of 6-inch-(150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.(232 sq. cm).
- F. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.
- G. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.6 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 4. Douglas Lighting Controls
 5. GE Industrial Systems; Total Lighting Control.
 6. Grasslin Controls Corporation; a GE Industrial Systems Company.
 7. Hubbell Lighting.
 8. Lighting Control and Design.
 9. Lithonia Lighting; Acuity Lighting Group, Inc.
 10. Square D; Schneider Electric.
 11. TORK.
 12. Touch-Plate, Inc.
 13. Watt Stopper (The).

- B. Description: Electrically operated and [**mechanically**] [**electrically**] held, combination type with [**fusible switch**] [**nonfused disconnect**], complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.7 EMERGENCY LIGHTING DEVICES

- A. Manufacturers:
1. Iota Engineering
 2. LVS, Inc.
 3. Philips Bodine
- B. Description: Generator (or central inverter) supplied egress lighting shall be provided by using a fixture equipped with an emergency lighting device (sometimes referred to as a generator transfer device).
1. The device shall be capable of bypassing the wall switch or other lighting controls when the normal power fails to the fixture and transfer to emergency power.
 2. Device shall operate at 120 or 277 VAC, 60 Hz;
 3. Device shall comply with the NEC.
 4. The device shall be UL 924 Listed for installation inside, on top of or remote from the fixture.
 5. In a DALI system, the system shall be UL 924 and programmed to turn on affected zones when a power loss is detected and to fail closed. ELD devices are not required with a DALI, UL 924 listed system when configured to meet emergency lighting requirements upon branch circuit power failure.
 6. The device shall be warranted for a full five years from date of purchase.

2.8 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lighting Control and Design, Inc.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
1. Coil Rating: 277 V.

2.9 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Install ceiling mounted sensors in the center of the lay-in ceiling tile when available.
- C. Install power packs above the accessible ceiling at the light switch location in room. If room does not have accessible ceiling and the adjacent corridor does, then install on corridor side. Install power pack in junction box to conceal the termination if installed on an exposed ceiling.
- D. Install according to manufacturer's recommendations.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm). All low voltage and communication cabling shall be run in conduit, refer to Section 26 0533 – Raceways and Boxes for Electrical Systems.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING

- A. Adjust time delay on each sensor to 15 minutes unless noted otherwise on plans.
- B. Coordinate light sensor level with owner to determine preferred operating range.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

END OF SECTION 26 0923

SECTION 26 0943.23 - LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacturer's catalog numbers, when listed in this section are for reference only. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.
- B. The system shall include but not be limited by the following list: Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relays panels controlled via a complete list of communication based accessories including digital switches, digital photocells, digital SmartBreaker panelboards, Digital Time Clock (DTC) and interface cards to dimming systems, building automation systems, thermostats, and other devices. The type of lighting control equipment and wiring specified in this section is covered by the description: Microprocessor Controlled Digital Relay Lighting Control system with RS 485 Bus communications. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each relay panel and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail wiring partition configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of relays.
 - 5. Include diagrams for power, signal, and control wiring.
 - 6. Product data for UPS supplied at each control panel.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
 - 3. Provide elevation of lighting control panels mounted on wall. Orient stacked and minimize wall space usage, consolidate into larger panels as feasible to keep future wall space for future added panels.

- B. Field quality-control reports.
- C. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panels for installation according to NECA 407.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with protocol described in IEC 60929, Annex E, for DALI lighting control devices, wiring, and computer hardware and software.
- E. Comply with NFPA 70.
- F. Lighting control relay panels shall be UL 916 Listed.
- G. Lighting control relay panels controlling emergency circuits shall be ETL listed to UL 924. Emergency source circuits controlled in normal operation by a relay panel shall fully comply with NEC 700-9(b). Electrical contractor to verify compliance.
- H. The lighting control system shall also be listed or approved by all national, state and local energy codes to include but not limited to California Title 24 and ASHRAE 90.1-2007.

1.7 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of lighting control functions.
 - 2. Coordinate lighting controls with HVAC controls. Design display graphics showing building areas controlled; include the status of lighting controls in each area.
 - 3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.
 - 4. Coordinate with fire alarm system, provide signal to turn on emergency lighting circuits in the event of a fire alarm.
- B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of software input/output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Damage of electronic components due to transient voltage surges.
 - 2. Warranty Period: Two years from date of Substantial Completion.
 - 3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
 - 4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of the software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crestron Electronics Inc.

2. Douglas Lighting Control
3. Intelligent Lighting Controls, Inc.
4. Leviton Mfg. Company Inc.
5. Lighting Control & Design, Inc.
6. Lightolier Controls; a Genlyte Company.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. Lutron Electronics Company, Inc.
9. MicroLite Lighting Control Systems.
10. NexLight; Northport Engineering Group.
11. Starfield Controls, Inc.
12. Touch-Plate, Inc.
13. Watt Stopper (The).

2.2 SYSTEM REQUIREMENTS

- A. The lighting control system is a networked system that communicates via RS485. The system must be able to communicate with fully digital centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells, various interfaces and shall include all operational software. The intent of the specification is to integrate all lighting control into one system, except for areas controlled by a single motion sensor such as rooms with a single luminaire and emergency fixtures designed to operate 24/7. Distributed lighting control shall be provided using a networked micro relay panel. A centralized relay panel shall control corridors and site lighting. Lighting control system shall include all hardware and software. Software to be resident within the lighting control system. System shall provide local access to all programming functions at the master LCP and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have server built into the master LCP that "serves" HTML pages to any authorize workstation. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital, non-server capable systems not acceptable.
- B. System software shall provide real time status of each relay, each zone and each group.
- C. Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on line PC or server for normal operation are not acceptable
- D. All devices shall be pre-addressed at the factory. Field addressing is not acceptable.
- E. All programs, schedules, time of day, etc, shall be held in non-volatile memory for a minimum of 10 years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.
- F. System shall be capable of flashing lights Off/On any relay or any zone prior to the lights being turned Off. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and not exceed 2-hours.
- G. The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches,

specification grade line voltage type wall switches, photocell, web based software or other devices connected to programmable inputs in a lighting control panel.

- H. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the master LCP and remotely via dial up modem and via the Internet. Remote connection to the lighting control system shall provide real time control and real time feedback.
- I. System may consist of centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells and various digital interfaces. Verify exact components specified. Micro relay panels, smart breaker panels, centralized relay panels and digital switches shall communicate as one network via RS485. Micro relay panels, mounted in each local area, per plans shall control all lighting fixtures in that space, provide power to occupancy sensors and take input from daylight sensor and occupancy sensors. Micro relay panels shall be capable of taking inputs from standard, line voltage type switches and outputting up to 8 independent 0v to 10v dimming signals. All micro relay panels and all devices connected to micro relay panels (switches, photocells and occupancy sensors, etc) shall be wired per lighting control manufacturers instructions.
- J. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, terminals, number of conductors in control cables, and control software.
- K. UPS: Provide with uninterruptable power supply battery system at each lighting control panel. Size as required for the panel power requirements with 40% spare capacity.

2.3 RELAY PANELS

- A. NEMA rated enclosure with screw cover or hinged door. Other NEMA types optional.
- B. 16 AWG steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120v, 277v and emergency circuits.
- C. LCP input power shall be capable of accepting 120v or 277v without rewiring
- D. Control electronics in the low voltage section shall be capable of driving 2 to 48, 30a, 18,000 SCCR rated latching relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control relays that default to Open, Normally Open Latching (NOL) or relays that default to Closed, Normally Closed Latching (NCL).
- E. Lighting control system shall be digital and consist of a Master LCP, Slave LCPs, Micro LCPs with up to 8 individual relays, digital switches, digital interface cards and if required, SmartBreaker panelboards. All system components shall connect and be controlled via a single Category 5, 4 twisted pair cable with RJ45 connectors, providing real time two-way communication with each system component. Analog systems are not acceptable.
- F. The lighting control system is a networked system that communicates via RS485 and includes centralized relay panels, micro relay panels, digital switches, photocells, various interfaces and operational software. The intent of the specification is to integrate all lighting control into one system. Lighting control system

shall include all hardware and software. Software to be resident within the lighting control system. System shall provide local access to all programming functions at the DTC and remote access to all programming functions via dial up modem and through any standard computer workstation running an industry standard internet browser. Lighting control system shall have server built into the master LCP that "serves" HTML pages to any authorized workstation. Desktop computers are not part of this section and will be provided by others. Non-networked, non-digital system not acceptable.

2.4 MICRO RELAY PANELS

- A. Micro relay panels shall have up to 8-30a, 18,000 SCCR rated lighting relays and shall control all lighting in the designated area indicated on the plans and be networked to centralized relay panels, micro relay panels, smart breaker panels, digital switches, photocells, various interfaces. Each micro relay panel shall provide minimum 300ma at 12/24vdc for powering occupancy sensors. Micro relay panels that require a separate occupancy sensor power pack are not acceptable.
- B. Micro relay panel shall provide a minimum 4-programmable photocell inputs, a minimum 4-programmable occupancy sensor inputs and matrixed contact closure inputs. This requirement is to insure integration of entire lighting system into one networked, lighting control system.
- C. Micro relay panels shall be capable of outputting minimum 4 and up to 8 independent 0v to 10v dimming signals, one independent dimming signal at each of 8 relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. All photocell setting must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

2.5 STANDARD OUTPUT RELAYS

- A. UL Listed 30 Amp, Latching, 18,000 SCCR, 277VAC Ballast and HID and 20 Amp Tungsten at 120 Vac.
- B. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8AWG wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable.
- C. Relays to be rated for 250,000 operations minimum at a full 30a lighting load, default to closed at normal power loss, Normally Closed Latching (NCL). All incandescent circuits shall be energized by use of a Normally Closed SoftStart™ (NCSS) relay rated at 100,000 operations at full 20a load. No exceptions.
- D. Optional relay types available shall include: Normally Open Latching (NOL) relay rated for 250,000 operations, a 600v 2-pole NO and NC and a Single Pole, Double Throw (SPDT) relay.

2.6 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary-contact, low-voltage type.
 - 1. Match color specified in Division 26 Section "Wiring Devices."
 - 2. Integral green LED pilot light to indicate when circuit is on.

- B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Division 26 Section "Wiring Devices."
- C. Wall Plates: Single and multigang plates as specified in Division 26 Section "Wiring Devices."
- D. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.
- E. All switches shall be digital and communicate via RS 485. Contact closure style switches, except as specified for connection to the micro relay panel matrixed contact closure inputs, shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.
- F. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for On only, Off only, On/Off (toggle), Raise (Dim up) and Lower (Dim down). Switches shall also be capable of being disabled for specified times. Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.
- G. Digital switches for high abuse areas (common areas, atrium, etc.) shall be vandal resistant, contain no moving parts, and be touch sensitive and available with up to three buttons in a single gang. Multi gang versions shall also be available. Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations. High abuse switches shall connect to the lighting control system digital bus. Each high abuse switch touch button shall be able to be control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for On, Off, Toggle or Maintain operation. All programming shall be done locally or remotely via dial up modem or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cmspark) without any interruption or failure in operation.

2.7 DTC - Digital Electronic Time Clock

- A. A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept interface inputs.
- B. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.
- C. The DTC shall be capable of controlling up to 126 digital devices on a single bus and capable of interfacing digitally with other individual busses using manufacturer supplied interface cards.
- D. The DTC shall accept control locally using built in button prompts and use of a 8 line 21-letter display or from a computer or modem via an on-board RS 232 port. All commands shall be in plain English. Help pages shall display on the DTC screen.

- E. The DTC shall be run from non-volatile memory so that all system programming and real time clock functions are maintained for a minimum of 15 years with loss of power.
- F. Pre-installed Unity™ lighting control software shall provide via local or remote PC a visual representation of each device on the bus, show real time status and the ability to change the status of any individual device, relay or zone. System shall be capable of running optional Unity GX lighting control software, which shall provide for directly importing vector based graphics. No exceptions.
- G. Pre-Installed modem that allows for remote programming from any location using a PC. Modem to include all necessary software for local or remote control.
- H. DTC shall provide system wide timed overrides. Any relay, group or zone that is overridden On, before or after hours, shall automatically be swept Off by the DTC a maximum of 2 hours later.

2.8 PHOTOCCELL

- A. Photocells to be mounted in location indicated on the plans. Photocells used for exterior lights shall provide multiple trips point from 1 roof mounted unit. All trips points shall be able to be changed remotely via Internet or dial up modem. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photocells to be certified to comply with the current energy code covering this project at time of submittal of plans for building permit.

2.9 INTERFACES

- A. For future expansion capability, system to have available all of the following interfaces:
 - 1. A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use shielded cable to connect input devices to interface card.
 - 2. Interface card providing digital communication from one system bus to another system bus, allowing up to 12,000 devices to communicate.
 - 3. An interface card that allows the DTC to control up to 32 digital XCI brand thermostats. Programming of thermostats to be able to done locally (at the DTC or a PC) or remotely, via modem, Internet or Ethernet.
 - 4. A voice prompted telephone override interface module. Interface module shall accept up to 3 phone lines and allow up to 3 simultaneous phone calls. Voice prompted menu and up to 999 unique pass codes shall be standard with each interface module.
 - 5. Software pre-installed to run Unity GX Graphical Interface Software. Unity GX software shall provide via local or remote PC a visual representation of a specific area or the total area of the project. GX full graphic pages shall be designed to the owner's specifications. Owner to provide to manufacturer all necessary files and criteria
 - 6. Direct digital interface to SmartBreaker panelboards. Relay panel and SmartBreaker panelboard circuits shall appear on the system software as similar, yet distinct, items and maintain all functions and features of the system software.
 - 7. Direct digital interface to DMX 512 based systems. DMX interface shall provide 14 global commands, each of which can be modified locally or remotely using lighting controls manufacturer supplied software. DMX interface shall be integral to the system bus and shall connect and be

controlled via a single Category 5, 4 twisted pair cable, providing real time response from the lighting control system to DMX commands.

8. Direct digital interface to building automation systems using DDC protocols such as BACnet, Metasys (N2), LonWorks, ModBus, etc that accept on/off commands, time schedules and report status of all relays in all panels in real time. Coordinate all interface requirements with the BAS provider. Interface cards shall "self populate" each individual relay and each group to the BAS. All BAS system programming required shall be the responsibility of the BAS system provider.

2.10 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5 for horizontal copper cable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway except in unfinished spaces. Minimum conduit size shall be ½ inch.
 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 2. Comply with requirements for cable trays specified in Section 26 0536 "Cable Trays for Electrical Systems."
 3. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. In a building renovation or expansion, provide connection and programming to existing lighting control system so the entire building is on one system.

3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Mount panel cabinet plumb and rigid without distortion of box.
- D. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems."
- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
- E. Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original to be given to owner, copies placed inside the door of each LCP.

3.5 INSTALLATION AND SET-UP

- A. Verify that conduit for line voltage wires enters panel in line voltage areas and conduit for low-voltage control wires enters panel on low-voltage areas. Refer to manufacturer's plans and approved shop drawings for location of line and low-voltage areas. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.
- B. For approved line voltage type micro relay panel switches connected to matrixed inputs of the micro relay panel, furnish #18 AWG solid conductors. For all other digital switches provide wiring required by system manufacturer.
- C. For classroom digital switches provide wiring required by system manufacturer

- D. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.
- E. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, commissioning of the lighting control system, and Owner instruction includes:
 - 1. Confirmation of entire system operation and communication to each device.
 - 2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors
 - 3. Confirmation of system Programming, photocell settings, override settings, etc.
 - 4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.
- F. Panels shall be located so that they are readily accessible and not exposed to physical damage.
- G. Panel locations shall be furnished with sufficient working space around panels to comply with the National Electrical Code.
- H. Panels shall be securely fastened to the mounting surface by at least 4 points.
- I. Unused openings in the cabinet shall be effectively closed.
- J. Cabinets shall be grounded as specified in the National Electrical Code.
- K. Lugs shall be suitable and listed for installation with the conductor being connected.
- L. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs.
- M. Maintain the required bending radius of conductors inside cabinets.
- N. Clean cabinets of foreign material such as cement, plaster and paint.
- O. Distribute and arrange conductors neatly in the wiring gutters.
- P. Follow the manufacturer's torque values to tighten lugs.
- Q. Before energizing the panelboard, the following steps shall be taken:
 - 1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.
 - 2. Remove shipping blocks from component devices and the panel interior.
 - 3. Remove debris from panelboard interior.
- R. Follow manufacturers' instructions for installation and all low voltage wiring.
- S. Service and Operation Manuals:
 - 1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.
 - 2. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor

plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.

- T. Comply with energy code lighting control system "Acceptance Requirements". Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party certify that controls are installed and calibrated properly. This is the installing contractors responsibility. Verify requirements with building authority.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- D. Lighting control panel will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
- B. Provide factory-authorized personal for the following lighting control services:
 - 1. Provide programming time including feedback and site visit with Owner present to program the zones and times with owner input. Notify Engineer what date and time is set up for programming session for optional attendance.
 - 2. Provide lighting controls on-site commissioning and coordination with electrical contractor after initial programming and before building is occupied.
 - a. Provide at least 3 days for a building less than 30,000 square foot.
 - b. Provide at least 5 days for a building less than 200,000 square foot.

3. Provide up to (8) hours of owner training with Owner present.
4. Provide additional time after substation completion and within 30 days of owner Final Acceptance to make one-set of Owner requested changes.

3.8 ADJUSTING

- A. Owner Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in programming scheduling, dimming and adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
- B. Occupancy sensors shall be adjusted for seamless operation, contractor will have to move sensor and adjust settings at no charge due to faulty operation of the sensor due to location or settings for up to 12 months from date of Substantial Completion.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software training for PC-based control systems. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 0943.23

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SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Sample Finishes: Provide sample coverplate / device finishes of all available to interior designer for selection and final approval of device and coverplates throughout space. Colors may vary per space and per wall material device is to be installed on. Samples for any coverplates and devices include but are not limited to outlets, lighting controllers, data and AV coverplates fire alarm devices and exit signs.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wiring Devices:
 - a. Cooper Wiring Devices
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Mfg. Company Inc.
 - d. Pass & Seymour/Legrand; Wiring Devices Div.
 2. Wiring Devices for Hazardous (Classified) Locations:
 - a. Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.
 - b. EGS/Appleton Electric Company.
 - c. Killark Electric Manufacturing Co./Hubbell Incorporated.
 3. Multi-outlet Assemblies:
 - a. The Wiremold Company.

2.2 RECEPTACLES

- A. Extra Heavy Duty/Industrial Grade Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, and UL 498.
1. NEMA 5-20R configuration, 125 volt, 20 ampere, listed as "tamper resistant".
 2. Use in mechanical rooms, higher abuse areas, lab areas and rough service areas.
- B. Tamper Resistant, Commercial Grade Straight-Blade Receptacles: Comply with NEMA WD 1, NEMA WD 6 and UL498.
1. NEMA 5-20R configuration, 125 volt, 20 ampere, listed as "tamper resistant".
- C. Tamper Resistant, Hospital Grade Straight-Blade Receptacles. Comply with NEMA WD 1, NEMA WD 6 and UL498.
1. NEMA 5-20R configuration, 125 volt, 20 ampere, listed as "tamper resistant".
 2. Acceptable products:
 - a. Cooper 8300.
 - b. Hubbell HBL8300.
 - c. Leviton 8300.
 - d. P & S 8300.
 - 3.
 - 4.
- D. Tamper Resistant, GFCI Hospital Grade Straight-Blade Receptacles: Feed-through type, comply with NEMA WD 6, UL498 and UL943. Must meet UL 2003 standards for diagnostic indication of miss-wiring, increased surge immunity, improved corrosion resistance and resistance to false tripping.

1. NEMA 5-20R configuration, 125 volt, 20 ampere, listed as “tamper resistant.”
 2. Use in buildings where hospital grade receptacles are required.
- E. GFCI Specification Grade Straight-Blade Receptacles: Feed-through type, comply with NEMA WD 6, UL498 and UL943. Must meet UL 2003 standards for diagnostic indication of miss-wiring, increased surge immunity, improved corrosion resistance and resistance to false tripping.
1. NEMA 5-20R configuration, 125 volt, 20 ampere, listed as “tamper resistant”.
 2. Use where indicated on drawings and breaker type GFCI protection is not provided and where access is restricted to facilities personal.
- F. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.
- G. Hazardous (Classified) Location Receptacles: Comply with NEMA FB 11.

2.3 SWITCHES

- A. Single and Multi-pole Switches: Comply with UL20.
- B. Snap Switches: 20A, 120/277 volt, AC, heavy-duty grade, quiet type.
- C. Keyed Switches: 20A, 120/277 volt, AC, heavy-duty grade, quiet type.
1. Provide two keys for each keyed switch installed on project. Turn-over keys to owner at time of Substantial Completion.
- D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
1. Wattage rating exceeds connected load by 30 percent minimum, except as otherwise indicated.
 2. Control: Continuously adjustable slider, toggle switch, or rotary knob; with single-pole or three-way switching to suit connections.
 3. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch(130-mm) wire connecting leads.

2.4 DEVICE PLATES

- A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel. Color shall match device color.
 3. Material for Unfinished Spaces: Galvanized steel.. Color shall match wiring device color.
 4. Provide device plates for all power and data outlets.

2.5 WET LOCATION RECEPTACLE COVERS

- A. Wet Location Receptacle Covers: Receptacles located outdoors or those indicated as weatherproof shall be equipped with covers that maintain the NEMA 3R weatherproof integrity when attachment plug caps are inserted.
 - 1. Covers shall be die cast aluminum with powder coat finish, UL listed and comply with NEC.
 - 2. Covers shall be:
 - a. Tay Mac Corporation # MX3200
 - b. Red Dot #CKSUV

2.6 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: No. 12 AWG.

2.7 WIRING DEVICE AND COVER FINISHES

- A. **Stainless:**
 - 1. **Covers to be stainless steel with white devices.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Install devices and assemblies level, plumb, and secure.
 - 2. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 3. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 4. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 5. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches(152 mm) in length.
 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
 10. Provide an individual GFCI receptacle for each one shown on the drawings. Do not feed downstream receptacles on the same circuit using the protection of a GFCI receptacle.
 11. Where GFCI receptacles are concealed behind either fixed or removable equipment, provide remote GFCI test device per NFPA-70 requirements.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

- A. Connect receptacles using screw-compression wiring contacts or pigtail leads. Do not use push-in contacts.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Remove damaged and defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 2726

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, LED modules and drivers.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for LED lighting fixtures.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 ACTION SUBMITTALS

- A. General: Some lighting fixtures may require at least 3 to 4 months of lead time. The Contractor is responsible for allowing sufficient time for the review process, manufacturing and delivery of these products. Substitutions will not be accepted on the basis of the Contractor's obligation to meet project completion deadlines.
- B. Lighting Fixtures Specified: The lighting fixtures specified in these documents have been carefully chosen for their ability to meet lighting requirements for this project. Selection has been based on esthetics, durability, ease of maintenance, luminance ratios, vertical and horizontal illuminances, lumen maintenance, CRI, efficacy, LED system life and warranty as well as their ability to satisfy governing codes such as ASHRAE/IES 90.1/1999. The Contractor is cautioned that substitute products are likely to be unable to meet all of the same criteria as the product specified.
- C. Substitutions: When proposing substitute products, the Contractor shall be responsible for the negotiation with the Owner and Architect/Engineer, prior to substitution submittal, to assure fees are available to redesign the project based on the proposed substitutions or review by the Architect/Engineer of all photometric, sample, design and calculations for the proposed substitutions. All substitutions must be identified at time of bid. The Contractor's bid value shall not be based on substitutions in expectation of design team approval, nor on the Contractor's estimated value of the products specified. If review of the proposed substitute light fixtures finds the product unacceptable, the Contractor shall provide the fixtures specified at no additional cost to the Owner or delay in the project completion time.
- D. Product Data: For each type of lighting fixture and lamp indicated, arranged in order of fixture designation. Submit fixture data in bound brochure. Include illustrations and dimensions of fixtures, and showing photometric performance. Include data on features, accessories, and the following:

1. Contract Drawing light fixture type designation.
 2. Dimensions of fixtures.
 3. Certified results of independent laboratory tests of fixtures and lamps for electrical ratings and photometric data.
 4. Emergency lighting unit battery and charger.
 5. LED fixture LM79, LM80 and TM21 testing data.
 6. Written Warranty Compliance
- E. Lighting Fixture Submittals: Fixture cuts lacking sufficient detail to indicate compliance with specifications will not be acceptable.
- F. Shop Drawings: Show details of nonstandard and custom fixtures. Indicate dimensions, weights, components, features, accessories, and methods of field assembly and mounting.
1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- G. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 01.

1.3 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. Comply with LM 79, LM80 and TM21 LED testing standards.
- D. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.
- E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
- F. Office of Fire Safety: All plastic diffusers used in lighting fixtures or luminous ceilings shall conform with NFPA 101, Life Safety Code, 1997 Edition, Section 6-5, Interior Finish. The light fixture manufacturer(s) shall furnish an affidavit stating compliance with this requirement for submittal to the State of Michigan Department of Labor & Economic Growth, Office of Fire Safety, P.O. Box 30254, Lansing, Michigan 48909.

1.4 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.5 WARRANTY

- A. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Special Warranty Period for Batteries: Manufacturer's standard 5 years from date of Substantial Completion. Full warranty shall apply for all 5 years.
- B. Warranty for LED fixtures: Written warranty, agreeing to replace drivers, LED modules and any fixture housing or components that fail in materials and workmanship within minimum (5) years from date of purchase. Warranty shall provide materials necessary to restore to acceptable operation. Labor shall be warranted for two years of the project substantial completion. The warranty shall include fixture replacement or component replacement if the luminaire delivers less than 90% of the initial light level over the rated life.
 1. For decorative pendant and track fixtures, warranty shall be minimum of (5) years.
 2. All other fixtures shall match the standard warranty of the fixture specified.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURE MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Lighting Fixture Schedule on the plans.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
 2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.
- F. Disconnecting Means: Provide disconnecting means for all LED fixtures. Disconnect shall comply with NEC Section 410.73(G).

2.3 LED FIXTURES

A. GENERAL

1. LED light fixtures shall meet all of the specified parameters with published independent testing in accordance with LM79, LM80 and TM21 testing standards.
2. LED light fixtures shall be sold as a complete system. Light fixtures shall have minimum efficacy as follows:
 - a. Linear Recessed LED (2x2,2x4,1x4,1x2): 95 Lumens per watt.
 - b. Linear Recessed LED (~4", Narrow Aperture): 74 Lumens per watt.
 - c. Linear Pendant LED (~4" Aperture): 95 Lumens per watt up, 74 Lumens per watt down.
 - d. Downlight LED: 80 Lumens per watt.
3. LED light fixtures shall have delivered lumen output within 5% of the delivered lumen output of the fixtures specified.
4. LED light fixtures shall be dimmable down to 20% or less of full output. If the specified fixture is dimmable to a level lower than 20%, equivalent fixture must be dimmable to the same level or lower than the fixture specified.
5. LED light fixture shall produce no noticeable variation in color temperature from one fixture to another by the same manufacturer. Color temperature shall be within 3-step MacAdam Ellipse.

B. LED DRIVERS

1. High performance LED driver to be 120/277V and wired for dimming or non-dimming. Provide with manufacturer tested compatible battery backup where indicated.
2. Driver expected lifetime shall be over 100,000 hours.
3. Total Harmonic Distortion Rating: Less than 20 percent.
4. Minimum power factor shall be 94%.

C. LED ENGINES

1. Manufacturers: Refer to light fixture schedule, light fixture is ordered as a complete system including LED driver, light engine and housing from the LED light fixture manufacturer.
2. LED Color Temperature and Minimum Color-Rendering Index:
 - a. Downlights: 4100 K and over 85 CRI
 - b. Linear LED: 4100 K and over 80 CRI
3. LED Life:
 - a. Downlights: Rated average shall be 50,000 hours rated per LM79, LM80 and TM-21 standards.
 - b. Linear LED: Rated average shall be 100,000 hours rated per LM79, LM80 and TM-21 standards.
 - c. Track and pendant heads: Rated average shall be 50,000 hours to 70% rated per LM79, LM80 and TM-21 standards.

2.4 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Refer to Lighting Fixture Schedule on the plans.

- B. Internally Lighted Signs: Features as follows:
 - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically energizes lamp from unit when circuit voltage drops to 80 percent of nominal or below. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.
- D. Wire Guard: Provide heavy chrome plated wire guards to protect fixtures installed in gymnasiums and multi-purpose rooms.

2.5 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Interior Lighting Systems shall be installed in accordance with NECA/IESNA 500, Recommended Practice for Installing Indoor Commercial Lighting Systems and NECA/IESNA 502-2011, Recommended Practice for Installing Industrial Lighting Systems.
- B. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials.
- C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Support fixture using grid plus the following:
 - 1. Fixtures shall be positively attached to the ceiling grid system.
 - 2. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches(150 mm) from fixture corners.
 - 3. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
 - 4. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently of panel, with at least two 3/4-inch(20-mm) metal channels spanning and secured to ceiling tees.
- D. Suspended Fixture:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with two separate stem hangers.
 - 3. Continuous Rows: Suspend from cable installed according to fixture manufacturer's written instructions and details on Drawings.
 - 4. Fixtures to be aligned and level, insure lenses are fastened properly in place.
 - 5. Any supports used to suspend fixture in exposed ceiling areas shall be installed as high as possible out of view and painted with ceiling.
 - 6. Mount remote type drivers out of site above ceilings or in painted enclosure.
 - 7. Coordinate installation so that no pipes, cable tray, duct work, etc are routed below light fixtures. Light fixtures shall be at a set plane so similar fixture types are all the same height or as noted on plans. Notify architects and engineers of any obstructions that will not allow for light to be installed at desired location.
- E. In Mechanical and Boiler Rooms, coordinate lighting fixture installation with mechanical piping, duct work, etc. Provide all required supporting rods and channel to bridge duct work and piping. Generally, mount fixtures 8-9 feet above floor unless noted otherwise. Avoid positioning above mechanical piping and ducts.

3.2 CONNECTIONS

- A. Ground equipment.
 - 1. Tighten electrical connections and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Provide instruments to make and record test results.
- C. Tests:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.
- D. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units are acceptable.
- E. Corroded Fixtures: Replace during warranty period.

3.5 STARTUP SERVICE

- A. Burn-in all fixtures that require specific aging period to operate properly, prior to occupancy by Owner.

3.6 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Fixture cones, reflectors, baffles, and visible trim shall be turned over to the owner clean and free of dust, drywall mud, smudges, fingerprints, and scratches. Only use methods and cleaning materials in accordance with respective fixture manufacturer recommendations.
- B. All adjustable light fixtures shall be aimed, focused and locked by the Contractor under the observation of the Architect/Engineer. When daylighting interferes with the aiming and focusing, aiming shall be accomplished during hours of darkness.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
 - 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 26 5100

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SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with LED modules and drivers.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

- a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Photoelectric relays.
7. LED fixture compliance of lumen maintenance, CRI, efficacy and LED system rated life and warranty.
8. LED fixture LM79, LM80 and TM21 testing data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.
- D. LED fixture written warranty compliance.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 10 of each type and rating installed. Furnish at least one of each type.
 - 2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.
- E. LED fixtures to be tested in compliance with LM79, LM80 and TM21 testing standards.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.
- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.
 - 5. Warranty Period for LED fixtures: Minimum (5) years from date of Substantial Completion.
 - a. LED fixture warranty shall state agreement to replace LED drivers, LED light engine modules, fixture housing, components or accessories under the warranty coverage term.
 - b. Warranty shall include replacement of fixtures or components if the luminaire delivers less than 90% of the initial light level over the 100,000 hour life.
 - c. Fixture warranty to be extended to meet all requirements at a minimum of the warranty of the basis of design fixture specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Lighting Fixture Schedule on the plans.

2.2 LUMINAIRES

- A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- B. Metal Parts: Free from burrs, sharp corners, and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit servicing without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during servicing and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect driver when door opens.
- F. Exposed Hardware Material: Stainless steel.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- I. Fixture to be provided with all required accessories including (but not limited to) Luminaire, Arm or Mount, Pole, specified accessories.
- J. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
- K. Photoelectric Relays: As follows:
 - 1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc(16 to 32 lx) and off at 4.5 to 10 fc(48 to 108 lx) with 15-second minimum time delay.
 - 2. Relay Mounting: In luminaire housing.

2.3 LED LIGHT FIXTURES:

- A. Light fixtures shall be UL listed and meet all of the specified parameters with published independent testing in accordance with LM79, LM80 and TM21 testing standards.
- B. Light fixtures shall be sold as a complete system. Light fixtures shall have a minimum efficacy of 75 lumens per watt or equal to that of the light fixture specified.
- C. Light fixtures shall have rated delivered lumen output within 5% of the rated delivered lumen output of the fixture specified.
- D. Light fixtures shall have accessible and replaceable drivers and LED light engine boards.
- E. LED drivers shall be 120/277V or 480V to match specified. LED drivers and light engines shall be Class 1 and have 100,000 hour rated life.
- F. Exterior fixtures to have one dimming driver per fixture head where dimming drivers are specified.
- G. LED driver Total Harmonic distortion shall be less than 20%.

- H. Light fixture minimum power factor shall be 90%.
- I. Light fixture color temperature shall be 4000K and minimum 90 CRI.
- J. Transient voltage surge suppression shall be 10kV integral to the fixture in accordance with IEEE/ANSI C62.41.2.
- K. Fixture shall be dark sky friendly.
- L. Fuses: One in each ungrounded supply conductor. Voltage and current ratings as recommended by ballast manufacturer. Fuses shall be installed in handhole near base of pole, not at fixture head.
- M. Occupancy Sensor: When occupancy sensor on the fixture is specified, the fixture shall be equipped with an integral passive infrared occupancy sensor device that changes the light level by dimming the light engine.
 - 1. The sensor shall also have the capability of providing ambient light sensing and adjusting light levels accordingly.
 - 2. The sensor shall have an adjustable time delay feature.
 - 3. The low and high dimming shall be field adjustable.

2.4 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.5 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.6 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
1. Shape: Square, tapered.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 2. Finish: Same as luminaire.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: As selected by Architect from manufacturer's full range.

2.7 POLE ACCESSORIES

- A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.
 1. Recessed, 12 inches (300 mm) above finished grade.
 2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, color to match pole, that when mounted results in NEMA 250, Type 3R enclosure.
 3. With cord opening.
 4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
- C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).

2. Water, Gas, Electric, Communication, and Sewer Lines: 5 feet (3 m).
 3. Trees: 10 feet (5 m) from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers unless otherwise indicated.
 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Dig holes large enough to permit use of tampers in the full depth of hole.
 2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).
- 3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES
- A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed unit for damage. Replace damaged units.
- B. Advance Notice: Give dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:
 - 1. Measure light intensities at night if specific illumination performance is indicated. Use photometers with calibration referenced to NIST standards.
 - 2. Check intensity and uniformity of illumination.
 - 3. Check excessively noisy ballasts.
- E. Prepare a written report of tests, inspections, observations and verifications indicating and interpreting results.
- F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

3.7 CLEANING AND ADJUSTING

- A. Clean units after installation. Use methods and materials recommended by manufacturer.

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**EXTERIOR LIGHTING
26 5600 - 10
12/21/2022**

- B. Adjust aimable luminaires and luminaires with adjustable lamp position to provide required light distributions and intensities.

END OF SECTION 26 5600

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and, grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting and capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
2. Division 32 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.2 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 4. Use only hand methods for grubbing within tree protection zone.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 1000

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete slabs-on-grade, walks, and pavement.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Sections include the following:

1. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Division 33 Section "Subdrainage" for drainage of foundations, slabs-on-grade, walls, and landscaped areas.
3. Division 33 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
4. Division 33 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
5. Division 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a concrete slab-on-grade, cement concrete pavement, or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 1.5 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
 - D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
 - E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
 - F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
 - G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
 - H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
 - I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
 - J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
 - K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- 2.2 GEOTEXTILES
- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 4. Tear Strength: 56 lbf; ASTM D 4533.
 5. Puncture Strength: 56 lbf; ASTM D 4833.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system, specified in Division 31 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Excavation for Structures: Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- C. Excavation for Walks and Pavements: Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- D. Excavation for Utility Trenches: Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - a. Clearance: 12 inches each side of pipe or conduit.
3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

- A. General: Place backfill on subgrades free of mud, frost, snow, or ice. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Utility Trench Backfill: Place backfill on subgrades free of mud, frost, snow, or ice.

1. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
2. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
3. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
4. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
5. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
6. Place and compact final backfill of satisfactory soil to final subgrade elevation.
7. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

C. Soil Fill: Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.9 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.10 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - a. Under slabs on grade, place 6 inches compacted depth of sand
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.11 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch .
 - 3. Pavements: Plus or minus 1/2 inch .
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.12 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

3.13 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698

3.14 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade and at footing drains as follows:
 - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft.(186 sq. m) or less of paved area or building slab, but in no case fewer than 3 tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet(30 m) or less of wall length, but no fewer than 2 tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet(46 m) or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- D. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 2000

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SECTION 31 2319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1.3 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, discharge lines, piezometers, and flow-measuring devices; and means of discharge, control of sediment, and disposal of water.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide temporary grading to facilitate dewatering and control of surface water.
- B. Monitor dewatering systems continuously.
- C. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 01 Section "Temporary Facilities and Controls", Division 31 Section "Site Clearing" during dewatering operations.
- D. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- E. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- F. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- G. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- H. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

END OF SECTION 31 2319

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
2. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Michigan Department of Transportation.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements by Michigan Department of Transportation for asphalt paving work.

C. Tennis Court Requirements: Comply with all guidance listed under "Asphalt for Athletic Uses" within the ASBA document entitled, *American Sports Builders Association Asphalt Guidelines* found at: www.sportsbuilders.org/publications/Asphalt_Guidelines.pdf.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Tennis Court Pavement Aggregates: Comply with all guidance listed under "Asphalt for Athletic Uses" within the ASBA document entitled, *American Sports Builders Association Asphalt Guidelines* found at: www.sportsbuilders.org/publications/Asphalt_Guidelines.pdf.
- D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.
- B. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Tennis Court Asphalt: Comply with all guidance listed under "Asphalt for Athletic Uses" within the ASBA document entitled, *American Sports Builders Association Asphalt Guidelines* found at: www.sportsbuilders.org/publications/Asphalt_Guidelines.pdf.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
- C. Tennis Court Color Coat Surfacing: A liquid-applied acrylic surface system designed specifically as a final coating on asphalt tennis courts.

1. Material: Refer to Specification Section 32 1823.53 "Tennis Court Surfacing".
2. Color: Yellow stripes and Blue for barrier free.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by Michigan Department of Transportation and complying with the following requirements:
 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 2. Base Course: as indicated
 3. Surface Course: as indicated

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify subgrade is dry and in suitable condition to begin paving
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Refer to Geotechnical reports issued for additional requirements of proof roll operation.
- D. Proceed with paving only after unsatisfactory conditions have been corrected.
- E. Tennis Court Liquid Applied Acrylic Surface:
 1. Prior to applying to the asphalt pavement, check surface to ensure there will not result in any areas which hold water after the application of the material.
 2. Test by flooding the court with water, look for drainage and "bird baths".
 3. Any areas found to hold water in excess of specified allowances must be patched with an approved patching compound.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 1. Mill to a depth indicated on the plans

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.
 - 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch(6 mm).
 - 2. Surface Course: 1/8 inch(3 mm).
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch(6 mm).
- C. Tennis Court Tolerances: Comply with all guidance listed under “Asphalt for Athletic Uses” within the ASBA document entitled, *American Sports Builders Association Asphalt Guidelines* found at: www.sportsbuilders.org/publications/Asphalt_Guidelines.pdf.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 10 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer’s recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.
- E. Tennis Court Color Coat Surfacing: Refer to Specification Section 32 1823.53 “Tennis Court Surfacing”.

3.11 TENNIS COURT LIQUID APPLIED ACRYLIC SURFACE

- A. Refer to Section 32 1823.53 “Tennis Court Surfacing”.

3.12 WHEEL STOPS

- A. Install wheel stops in bed of adhesive as recommended by manufacturer.
- B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 1216

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SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
 - 5. Unit paver base.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete pavement mixture.
- C. Material Certificates: Signed by manufacturers certifying that each material complies with requirements:
- D. Minutes of preinstallation conference.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives of each entity directly concerned with concrete pavement, to attend conference:

1.4 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I/II, **[gray]** **[white]**. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 - 1. Coarse Aggregate: MDOT 6A or MDOT 6AA.
 - 2. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 3. Fine Aggregate: MDOT 2NS.
 - 4. Do not use fine or coarse aggregates containing substances that cause spalling.
 - C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - D. Water: ASTM C 94/C 94M.
 - E. Air-Entraining Admixture: ASTM C 260.
 - F. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 3/4 inches long.
 - 1. Products:
 - a. Monofilament Fibers:
 - 1) FORTA Corporation; Forta Mono.
 - 2) Grace, W. R. & Co.--Conn.; Grace MicroFiber.

3) SI Concrete Systems; Fibermix Stealth.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers:
 - a. Bayer Corporation.
 - b. Conspec Marketing & Manufacturing Co., Inc.
 - c. Davis Colors.
 - d. Scofield, L. M. Company.
 - e. Solomon Colors.
 - 2. Color: As selected by Architect
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
 - b. Euclid Chemical Company (The); Surface Retarder S.
 - c. Scofield, L. M. Company; Lithotex.
 - d. Sika Corporation, Inc.; Rugasol-S.

- F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
 - b. Dayton Superior Corporation; Quartz Tuff.
 - c. Lambert Corporation; Colorhard.
 - d. Scofield, L. M. Company; Lithochrome Color Hardener.
 - e. Symons Corporation; Hard Top.
- G. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-115, Type I or AASHTO M 248, Type F.
 - 1. Color: Blue for handicapped requirements, yellow elsewhere.

2.8 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 5-1/2 percent plus or minus 1.5 percent.
- B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons
 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

3.2 INSTALLATION

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Edge Forms and Screed Construction: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
1. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Joints, General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

2. Provide tie bars at sides of pavement strips where indicated.
 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Concrete Placement: Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
1. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
 2. Do not add water to fresh concrete after testing.
 3. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
 4. Screed pavement surfaces with a straightedge and strike off.
 5. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
 6. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
 7. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

- a. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
8. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
9. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
10. Hot-Weather Placement: Comply with ACI 301 when hot-weather conditions exist:

3.7 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
- C. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
 1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- D. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on pavement surface. Tamp aggregate into plastic concrete, and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
 1. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- E. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
 1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.
- F. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to pavement surface according to manufacturer's written instructions and as follows:
1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft, unless greater amount is recommended by manufacturer to match pavement color required.
 2. Uniformly distribute approximately two-thirds of dry-shake hardener over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second dry-shake hardener application, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed by power floating.
 3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete.
 4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.
- G. Penetrating Liquid Slab Treatment: Prepare, apply, and finish penetrating liquid slab treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these methods.

3.9 PAVEMENT MARKING

- A. Pavement Marking: Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
 1. Sweep and clean surface to eliminate loose material and dust.

2. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

- A. Wheel Stops: Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4 inch(.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

- a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

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SECTION 32 1723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes painted markings applied to asphalt pavement.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches (200 mm) square.

1.3 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.
 - 1. Color: Blue for barrier-free marking and yellow elsewhere unless indicated otherwise.

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**PAVEMENT MARKINGS
32 1723 - 2
12/21/2022**

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils. Apply paint so that it cannot run beneath the stencil.

END OF SECTION 32 1723

SECTION 32 1823.53 – TENNIS COURT SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Asphalt tennis court surface color coat system. This includes all labor, materials, tools, equipment and services necessary for completing the color coat surface on tennis courts, including saw-cutting and sealing joints, as shown on the Drawings.

- B. Related Sections:

- 1. Section 11 6800 "Play Field Equipment and Structures" for tennis court equipment.
- 2. Section 32 1216 "Asphalt Paving" for bituminous asphalt paving of tennis courts.

1.3 REFERENCE STANDARDS

- A. American Sports Builders Association (ASBA).
- B. United States Tennis Association (USTA) Rules of Tennis.
- C. International Tennis Federation (ITF).
- D. U.S. Tennis Court and Track Builders Association (USTCTBA)
- E. United States Tennis Association (USTA).
- F.

1.4 SUBMITTALS

- A. Product Data

- 1. Submit manufacturer's product data, including surface and crack preparation and application instructions.
- 2. Submit system components Technical Data Sheets (TDS) and one Color Chart.
- 3. Submit current Material Safety Data Sheets.
- 4. Submit current ISO Quality Management System Certification certificate.

- B. Samples: Submit manufacturer's color samples of color coating.

C. Test Reports:

1. Submit independent test results for 2000 Hour ASTM G154, accelerated weathering UV test, to demonstrate long-term durability and fade resistance.
2. Submit independent test results for 2000 Hour, accelerated weathering ASTM G155 Xenon Arc test, to demonstrate long-term fade resistance and quality of pigment.
3. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
4. Manufacturer's Project References: Submit manufacturer's list of successfully completed asphalt tennis court surface color coating system projects, including project name, location, and date of application.
5. Applicator's Project References: Submit applicator's list of successfully completed asphalt tennis court surface color coating system projects, including project name, location, type and quantity of color coating system applied, and date of application.

- D. Touch-up Paint: Provide Owner with five (5) gallons of each color, plus one (1) gallon of striping paint for future touch-up.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Qualification Data: For qualified Installer and testing agency.
- C. Material certificates.
- D. Material test reports.
- E. Product certificates.
- F. Product test reports.
- G. Field quality-control reports.
- H. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 1. Manufacturer regularly engaged, for past 5 years, in manufacture of asphalt tennis court surface color coating systems of similar type to that specified.
 2. United States owned company.
 3. Member: ASBA.

4. Manufacturer has surfaces that are classified by the ITF's pace classification program.

B. Applicator's Qualifications:

1. Applicator regularly engaged, for past 3 years, in application of tennis court surface color coating systems of similar type to that specified.
2. Employ persons trained for application of tennis court surface color coating systems.
3. All work shall be done in accordance with American Sports Builders Association (ASBA) guidelines.
4. The Applicator shall record the batch number of each product used on the site and maintain it through the warranty period.
5. The contractor shall provide the inspector, upon request, an estimate of the volume of each product to be used on the site.

1.8 SPECIAL PROJECT WARRANTY

- A. Warranty: Tennis court surface is to be guaranteed for a period of five years against all defects in materials and workmanship, including such defects as bubbling, delamination, peeling, loss of integrity and excessive wear. The warranty does not cover defects caused by improper design or construction of the base, vandalism, neglect or natural disasters.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 1. Store and handle materials in accordance with manufacturer's instructions.
 2. Keep materials in manufacturer's original, unopened containers and packaging until application.
 3. Store materials in clean, dry area indoors.
 4. Store materials out of direct sunlight.
 5. Keep materials from freezing.
 6. Protect materials during storage, handling, and application to prevent contamination or damage.
 7. Close containers when not in use.

PART 2 - PRODUCTS

- 1.

2.2 MANUFACTURER

- A. Basis of design is "SportMaster Color Coating System" by SportMaster Sport Surfaces, PO Box 2277, 2520 South Campbell Street, Sandusky, Ohio 44870. Toll Free 800-326-1994. Fax 877-825-9226. Website www.sportmaster.net. E-mail info@sportmaster.net.

2.3 MATERIALS

- A. Asphalt Tennis Court Surface Color Coating System: SportMaster Color Coating System.
- B. Crack Sealant: SportMaster "Crack Magic".
 - 1. 100 percent acrylic emulsion elastomeric crack sealant.
 - 2. Seals cracks up to 1/2 inch wide in asphalt pavement.
 - 3. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
 - 4. Non-Volatile Material: 61 percent, plus or minus 5 percent.
 - 5. Color: to be selected by Owner from manufacturer's full standard color range.
- C. Crack Filler: SportMaster "Acrylic Crack Patch".
 - 1. 100 percent acrylic emulsion trowel-grade crack filler.
 - 2. Fills cracks in asphalt pavement up to 1 inch wide.
 - 3. Chemical Characteristics, by Weight, Minimum:
 - a. Acrylic Emulsion: 10.0 percent.
 - b. Hiding Pigment: 0.2 percent.
 - c. Mineral Inert Fillers: 78.0 percent.
 - d. Film Formers, Additives: 1.8 percent.
 - e. Water: 8.5 percent.
 - 4. Weight per Gallon at 77 Degrees F: 15.2 lbs., plus or minus 1.0 lbs.
 - 5. Non-Volatile Material: 80 percent, plus or minus 5 percent.
 - 6. Color: to be selected by Owner from manufacturer's full standard color range.
- D. Patch Binder: SportMaster "Acrylic Patch Binder".
 - 1. 100 percent acrylic emulsion liquid binder.
 - 2. Mix on-site with sand and cement.
 - 3. Levels and repairs low spots and depressions up to 3/4 inch deep in asphalt pavement.
 - 4. Fills Cracks in Asphalt up to 1" in width.
 - 5. Weight per Gallon at 77 Degrees F: 8.8 lbs., plus or minus 0.5 lbs.
- E. Filler Course: SportMaster "Acrylic Resurfacer".
 - 1. 100 percent acrylic emulsion resurfacer.
 - 2. Mix on-site with silica sand.
 - 3. Apply to asphalt surfaces or previously colored acrylic surfaces in preparation of color coating system.
 - 4. Chemical Characteristics, by Weight, Minimum:
 - a. Acrylic Emulsion: 44.0 percent.
 - b. Hiding Pigment: 2.0 percent.
 - c. Mineral Inert Fillers: 5.0 percent.
 - d. Film Formers, Additives: 0.2 percent.
 - e. Water: 45.0 percent.
 - 5. Weight per Gallon at 77 Degrees F: 8.5 lbs., plus or minus 0.5 lbs.
 - 6. Non-Volatile Material: 27.5 percent, plus or minus 5.0 percent.
 - 7. Color: Black.

- F. Color Coating: SportMaster "ColorPlus System".
1. 100 percent acrylic emulsion coating.
 2. Mix on-site with silica sand and water.
 3. Color coats tennis and multipurpose courts.
 4. Weight per Gallon at 77 Degrees F: 9.2 lbs., plus or minus 0.5 lbs. Retain this article if geosynthetics are specified in this Section; delete if specified elsewhere.
 5. Colors
 - a. To be selected by Owner from manufacturer's full standard color range.
 - b. Basis of design colors: Blue within court, and Dark Green in surrounding areas.
 - c. Colors may include (but not be limited to) Beige, Blue, Brown, Dark Green, Dove Gray, Forest Green, Gray Ice Blue, Light Blue, Light Green, Maroon, Red, Sandstone, Tournament Purple, Orange, or Yellow.
- G. Line Markings Primer: SportMaster "Stripe-Rite".
1. 100 percent acrylic emulsion primer, clear drying.
 2. Primes line markings and prevents bleed-under for sharp lines.
 3. Chemical Characteristics, by Weight, Nominal:
 - a. Acrylic Emulsion: 38.0 percent.
 - b. Hiding Pigment: 0.0 percent.
 - c. Mineral Inert Fillers: 7.0 percent.
 - d. Film Formers, Additives: 1.5 percent.
 - e. Water: 50.0 percent.
 4. Weight per Gallon at 77 Degrees F: 8.9 lbs., plus or minus 0.5 lbs.
 5. Non-Volatile Material: 29 percent, plus or minus 5 percent.
- H. Line Paint: SportMaster "Textured Line Paint".
1. Pigmented, 100 percent acrylic emulsion line paint.
 2. Line marking on asphalt tennis courts.
 3. Chemical Characteristics, by Weight, Nominal:
 - a. Acrylic Emulsion: 25.89 percent.
 - b. Pigment: 14.90 percent.
 - c. Mineral Inert Fillers: 13.12 percent.
 - d. Additives: 4.73 percent.
 - e. Water: 41.36 percent.
 4. Weight per Gallon at 77 Degrees F: 10.65 lbs., plus or minus 0.75 lbs.
 5. Non-Volatile Material: 45.17 percent, plus or minus 5 percent.
 6. Color: White.

PART 3 - EXECUTION

3.1 PREINSTALLATION CONFERENCE

- A. Conduct conference at project site to ensure coordination between all impacted trades.

3.2 STANDARDS

- A. The work shall be done in a thorough, workmanlike manner and conform to standard for construction as prescribed or approved by the USTCTBA, USTA, and ASBA.
- B. Layout: The work shall be laid out to true lines and grades in full accord with the Drawings.
- C. Planarity and Slope: Before application of the color surface course, the asphalt base will be tested with a ten foot (10') straight-edge. There shall be no deviation from the specified grade in excess of 1/8".

3.3 EXAMINATION

- A. Examine asphalt tennis court surfaces to receive color coating system.
- B. Verify asphalt tennis courts meet USTCTBS, USTA, and ASBA requirements.
- C. In accordance with the U.S. Tennis Court and Track Builder's Association recommendations, the following testing shall be undertaken to ensure positive drainage and eliminate "birdbaths":
 - 1. Prior to application of the color finish system, the court surface shall be flooded with water and allowed to drain for one hour at 70 degrees Fahrenheit.
 - 2. If there is any remaining water that covers a 5 cent piece (American coin), that area, commonly called a "birdbath", shall be patched and leveled in accordance with recommendations of the manufacturer of the color finish system specified. (Note: If the standing water does not cover a 5 cent piece, it is considered within tolerance and will evaporate within a reasonable time.)
 - 3. Re-flooding and patching will be necessary until "birdbaths" are properly minimized.
- D. Notify Architect of conditions that would adversely affect application or subsequent use.
- E. Do not begin surface preparation or application until unacceptable conditions are corrected.

3.4 AMBIENT CONDITIONS

- A. Do not apply asphalt tennis court surface color coating system when air or surface temperatures are below 50 degrees F, or in excess of 140 degrees F during application or within 24 hours after application.
- B. Do not apply asphalt tennis court surface color coating system when rain is expected during application or within 24 hours after application.

3.5 SURFACE PREPARATION

- A. Protection of In-Place Conditions: Protect adjacent surfaces and landscaping from contact with asphalt tennis court surface color coating system.
- B. Prepare surfaces in accordance with manufacturer's instructions.
- C. Cure new asphalt surfaces a minimum of 21 days before application of asphalt tennis court surface color coating system.

- D. Remove dirt, dust, debris, vegetation, loose materials, and other surface contaminants which could adversely affect application of asphalt tennis court surface color coating system. Pressure wash entire surface.
- E. Remove all grease and oil by using a strong solution of detergent and water followed by thorough flushing of the surface with water. Excess water in the form of pools or puddles must be removed. Surface can be left damp, which is preferable to a dry surface.
- F. Repair cracks, depressions, and surface defects in accordance with manufacturer's instructions before application of filler course and color coating.
- G. Level depressions 1/8 inch and deeper with patch binder in accordance with manufacturer's instructions.
- H. Apply 1 or 2 coats of filler course as required by surface roughness and porosity to provide smooth underlayment for application of color coating.
- I. Ensure surface repairs are flush and smooth to adjoining surfaces.

3.6 APPLICATION

- A. Apply asphalt tennis court surface color coating system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Mix materials in accordance with manufacturer's instructions.
- C. Each coat in this system must dry completely before next application. Between each coat, inspect entire surface. Any defects should be repaired. Scrape surface to remove any lumps, and broom or blow off all loose matter.
- D. Apply Filler Course and Color Coating with a 50-60 durometer, soft rubber squeegee.
- E. Filler Course:
 - 1. Apply 2 coats on new asphalt or existing acrylic surfaces with extensive cracks or low spot repair.
 - 2. Apply 1 coat on existing acrylic surfaces with minimal repairs.
- F. Color Coating: Apply a minimum of 2 coats of color coating to prepared surfaces in accordance with manufacturer's instructions.
- G. Allow material drying times in accordance with manufacturer's instructions before applying other materials or opening completed surface to foot traffic.

3.7 LINE MARKINGS

- A. Lay out tennis court line markings in accordance with USTA Rules of Tennis.
- B. Surface Preparation: Sweep and clean the surface to eliminate loose material, dust, and oil.
- C. Conditions: Line painting will not be permitted when humidity exceed 85% or when air temperature falls below 40 Degrees F.

- D. Application of Lines: Apply playing lines in accordance with USTA specifications.
 - 1. Apply line markings primer, after masking tape has been laid, to seal voids between masking tape and tennis court surface to prevent bleed-under when line paint is applied.
 - 2. Lines shall be masked with tape and hand brushed or rolled in place.
 - 3. Apply two (2) coats paint, at rate recommended by manufacturer.

3.8 JOINT SEALANT

- A. Application: Seal joints according to manufacturer's recommendations, after application of color coating system is complete.

3.9 PROTECTION

- A. Allow a minimum of 24 hours curing time before opening tennis courts for play.
- B. Protect applied asphalt tennis court surface color coating system to ensure that, except for normal weathering, coating system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 32 1823.53

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Manual swing gates.

B. Related Sections:

1. Section 03 3000 "Cast-in-Place Concrete" for cast-in-place concrete post footings.
2. Section 11 1200 "Parking Control Equipment" for mechanical/electrical rolling drive gates.
3. [Section 03 3000 "Cast-in-Place Concrete"] [Section 03 3053 "Miscellaneous Cast-in-Place Concrete"] for cast-in-place concrete [equipment bases/pads for gate operators and controls] [post footings].

1.2 PERFORMANCE REQUIREMENTS

- A. Verify Design: Provide chain-link fences and gates, verifying engineering analysis by a qualified professional engineer, using performance design criteria for fence heights indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
- C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate latches, and operational clearances.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified [professional engineer] [testing agency] [factory-authorized service representative].
- B. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.
- C. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.
- D. Product Test Reports: For framing strength according to ASTM F 1043.

E. Field quality-control reports.

F. Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

D. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Include 10-foot length of fence[and gate].

E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.

3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Steel Wire Fabric: Wire with a diameter of 0.148 inch (3.76 mm).
 - a. Mesh Size: 2 inches for all applications, as indicated on drawings
 - b. Fabric: thermally fused polyvinyl chloride (PVC) coated per ASTM F 668, Type 2b, over No. 9 gauge galvanized wire with a minimum break strength of 1,290 pounds.
 - c. Color: Black, complying with ASTM F 934.
 - d. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 - e. Tension bars shall be galvanized 1/4" x 3/16" steel w/ PVC coating matching fabric.
 - f. Pressed steel bands shall be galvanized 11 gauge steel w/ PVC coating matching fabric.
 - g. Fabric ties shall be 9 gauge wire matching fabric material and coatings.
 2. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Metallic Coating for Steel Framing:
 - a. Type A zinc coating.
 2. Polymer coating over metallic coating.
 - a. Color: Black, complying with ASTM F 934.
 3. Fence Height: As indicated on Drawings.
 4. Line, terminal, & pull posts; top, middle, and bottom rails; braces and gate frames
 - a. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40, with an average not less than 2.0 ounces per square foot. No individual specimen shall show less than 1.8 ounces per foot zinc coating conforming to ASTM F 1083.
 - b. Interior coating: Conforming to ASTM F 1234T Types B and D.
 - c. Line Post: as indicated, but no less than:
 - 1) Posts for Fencing 6 feet or Less in Height: Outside dimension of 1.90" and a minimum weight of 2.72 pounds per foot; both prior to addition of PVC coating.

- 2) Posts for Fencing 6'-1" to 8'-0" in Height": Outside dimension of 2.375" and a minimum weight of 3.65 pounds per foot; both prior to addition of PVC coating.
 - 3) Posts for Fencing 8'-1" and Over in Height: Outside dimension of 2.875" and a minimum weight of 5.79 pounds per foot; both prior to addition of PVC coating.
- d. End, Corner and Pull Post: as indicated, but no less than:
- 1) Posts for Fencing 6 feet or Less in Height: Outside dimension of 2.375" and a minimum weight of 3.65 pounds per foot; both prior to addition of PVC coating.
 - 2) Posts for Fencing 6'-1" to 12'-0" in Height": Outside dimension of 2.875" and a minimum weight of 5.79 pounds per foot; both prior to addition of PVC coating.
 - 3) Posts for Fencing 12'-1" and Over in Height: Outside dimension of 4.000" and a minimum weight of 9.10 pounds per foot; both prior to addition of PVC coating.
- e. Corner, end, or pull posts each side of windscreen to be increased in size one size from table above.
5. Horizontal Framework Members: Intermediate, top, bottom, and brace rails complying with ASTM F 1043.
- a. Rails and Braces: as indicated, but no less than:
- 1) Type I, Schedule 40 steel pipe with an outside dimension of 1.660 inches, and a minimum weight of 1.83 pounds per foot; both prior to addition of PVC coating.

2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.148-inch- (3.8-mm-)diameter, tension wire complying with ASTM F 1664, Class 2a over zinc-coated steel wire.
1. Color: Black, complying with ASTM F 934.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single double swing gate types.
1. Gate Frame and Posts
 - a. All joints shall be welded or otherwise fastened to form a rigid frame.
 - b. Intermediate braces and truss rods of sufficient strength to prevent sagging shall be used.
 - c. Frames: furnished complete with approved hinges, positive latching devices that will accommodate pad locking, keepers, and stops.
 - d. Posts for Leafs of 6'-0" or Less in Width
 - 1) Type I Schedule 40 steel pipe having an outside dimension of 2.875" and a minimum weight of 5.79 pounds per foot; both prior to addition of PVC coating.
 - e. Posts for Gate Leafs of 6'-1" to 13'-0" on Width
 - 1) Type I Schedule 40 steel pipe having an outside dimension of 4.00" and a minimum weight of 9.10 pounds per foot.
 - f. Posts for Gate Leafs of 13'-1" to 18'-0" in Width

- 1) Type I Schedule 40 steel pipe having an outside dimension of 6.625" and a minimum weight of 18.97 pounds per foot.
- g. Posts for Gate Leafs of 18'-1" and Larger in Width
 - 1) Type I Schedule 40 steel pipe having an outside dimension of 8.625" and a minimum weight of 24.70 pounds per foot.
- h. Gate posts shall be equipped with tops (matching framework black polymer coating) to exclude water.
- 2. Gate Leaf Width: As indicated.
- 3. Gate Fabric Height: As indicated.

B. Pipe and Tubing:

- 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
- 2. Gate Posts: Round tubular steel.
- 3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

- 1. Hinges: 360-degree inward and outward swing.
- 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
- 3. Closer: Forks and drop pins as indicated. Verify on shop drawings.

2.5 Concrete Footings

A. All posts shall be set plumb and in accordance with the following table:

1.	Line Post				
	<u>Fabric Height</u>	<u>Post Depth</u>	<u>Diameter of Base</u>	<u>Base Depth</u>	<u>Maximum Spacing</u>
	0' to 6'-0"	30"	10"	36"	8'-0"
	6'-1" to 12'-0"	30"	12"	36"	8'-0"
	12'-1" to 16'-0"	30"	14"	36"	8'-0"
2.	Pull Post				
	<u>Fabric Height</u>	<u>Post Depth</u>	<u>Diameter of Base</u>	<u>Base Depth</u>	<u>Maximum Spacing</u>
	0' to 6'-0"	30"	12"	3'-6"	500' *
	6'-1" to 12'-0"	34"	14"	3'-6"	500' *
	12'-1" to 16'-0"	36"	16"	4'-0"	500' *

* Required at all tangent points on curved fence layouts.

3. Leaf Gate Post

<u>Fabric Height</u>	<u>Post Depth</u>	<u>Diameter of Base</u>	<u>Base Depth</u>
0' to 6'-0"	42"	12"	48"
6'-1" to 10'-0"	50"	16"	56"
10'-1" to 15'-0"	56"	20"	62"
15'-1" to 18'-0"	62"	24"	68"

2.6 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
- E. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
 - a. Polymer coating over metallic coating.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

2.8 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper or Aluminum.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2440 mm).

2.9 FENCE GROUNDING

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- C. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated. Framing
 1. Set posts in drilled holes and in center of concrete. Drilled holes to be spaced equally between corner and end or pull posts, and maximum spacing of 8'-0" on center.
 2. Holes: Fill with concrete and the top crowned at 1/2" per foot to prevent accumulation of water.
 3. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top below grade as indicated on Drawings to allow covering with surface material.
 4. Concrete shall cure a minimum of 72 hours prior to installation of fabric.
 5. Fencing shall follow natural ground surface, but ignore minor irregularities in grade.
 6. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
- E. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.
- F. Line Posts: Space line posts uniformly at 8 feet on center.
- G. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 1. Locate horizontal braces at mid-height of fabric, on fences with top rail.
 2. Install so posts are plumb when diagonal rod is under proper tension.

- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- J. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage unless otherwise indicated.
 - 1. Fabric Installation
 - a. The fabric shall be securely fastened to all terminal, corner, and/or pull posts by 1/4" x 3/4" tension bars with 11 gauge pressed bands spaced at 12" apart.
 - b. Attach to line posts a maximum of 18" on center and to top, bottom, and intermediate rail at a minimum of 24" apart with 9 gauge steel wire ties.
 - c. Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) on center.
 - d. Position the bottom of the fabric 2" above finish grade.
 - 2. Braces and Tension Wire
 - a. Top rail shall be provided with couplings every 18 feet.
 - b. Couplings shall be the outside sleeve type and at least 6" long.
 - c. Top rail shall pass through base of post top and form a continuous brace end to end of each stretch of fence.
 - d. Top, bottom, and intermediate rail shall be required and securely fastened at all end, gate, pull, and corner post locations by means of suitable pressed steel connections.
 - e. Horizontal braces shall be furnished for end, gate, and corner posts.
 - f. Braces are to be spaced midway between top rail and ground, and extend to the first line post
 - g. Braces shall be securely fastened to posts by means of pressed steel connections and trussed from the line post back to end, gate, or corner post with 3/8" round rod.
 - h. Corner, end, pull, and gate posts shall be braced to the nearest line post. Corner posts shall be braced in each direction to the nearest line post.
 - i. Bottom tension wire shall be properly tightened and clipped to the fence fabric on minimum 24" on center with 11 gauge steel hog rings.
 - j. Tie Wires:
 - 1) Use wire of proper length to firmly secure fabric to line posts and rails.
 - 2) Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626.
 - 3) Bend ends of wire to minimize hazard to individuals and clothing.
 - 4) Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) o.c. and to braces at 24 inches (610 mm) o.c.
 - 3. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- K. Gates
 - 1. Install according to manufacturer's written instructions, level, plumb, and secure for full opening without interference.

2. Install fabric on gate frame with 1/4" x 3/4" tension bars and 11 gauge pressed steel bands.
3. Position the hinges on the gate posts and frames to provide 2" clearance between the frame and finish grade.
4. Adjust all components to provide for proper alignment and operation.
5. All swing gates shall have galvanized & black polymer-coated inground gate keeper to accept vertical end gate support bar.
6. Attach hardware using tamper-resistant or concealed means.
7. Install ground-set items in concrete for anchorage.
8. Adjust hardware for smooth operation and lubricate where necessary.
9. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding
10. Horizontal Sliding Gates: Cantilever support posts shall be set in concrete footers having a minimum depth of 48" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.
11. Horizontal Sliding Gates: Cantilever Gate to be installed per manufacturers gate installation instructions. Gate shall be installed in compliance with ASTM F2200 standards.

L. Grounding and Bonding:

1. Fence Grounding: Install at maximum intervals of 500 feet.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 32 3113

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SECTION 32 3900 - MISCELLANEOUS SITE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bollards.

B. Related Requirements:

1. Division 03 Section "Cast-in-Place Concrete" for installing pipe sleeves cast, installing anchor bolts cast, formed voids in concrete footings.
2. Division 31 Section "Earth Moving" for excavation for installing concrete footings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Certificates for Credit MR 6: Chain-of-custody certificates indicating that wood components of site furnishings comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

C. Samples: For each exposed product and for each color and texture specified.

D. Samples for Initial Selection: For units with factory-applied finishes.

E. Samples for Verification: For each type of exposed finish, not less than 6-inch- (152-mm-) long linear components and 4-inch- (102-mm-) square sheet components.

1. Include full-size Samples of bollard.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 BOLLARDS

A. Pipe Utility Bollard As follows:

1. Products: Subject to compliance with requirements, provide one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. BRP Enterprises, Inc.
 - b. Canterbury International.
 - c. Columbia Cascade Company.
 - d. Creative Pipe, Inc.
 - e. Dero Bike Rack Co.
 - f. DuMor Inc.
 - g. FairWeather Site Furnishings; Division of Leader Manufacturing, Inc.
 - h. Huntco Supply, LLC.
 - i. Keystone Ridge Designs, Inc.
 - j. L. A. Steelcraft.
 - k. Maglin Site Furniture Inc.
 - l. Thomas Steele; Division of Trilary, Inc.
 - m. Urban Accessories, Inc.
 - n. Victor Stanley, Inc.
3. Bollard Construction:
 - a. Pipe OD: Not less than 6 inches (115 mm).
 - 1) Steel: Schedule 80 pipe.
 - b. Round
 - c. Style: Dome top.
 - d. Overall Height: As indicated.
 - e. Overall Width: As indicated.
 - f. Overall Depth: As indicated.
 - g. Installation Method: Cast in concrete.

B. Flexible Bollard: As follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the following, Ideal Shield Flexible Bollard, or comparable product by one of the following:
2.
 - a. **Ideal Shield Standard Flex System:** Standard - Carbon steel torsion spring with 1/2" zinc-coated bolts with 360 degree flexibility
Base Plate: 9.5" square 7 gauge standard steel base plate
Bollard Cover: Comes with 1/8" Cover (other options available)
Heights: 60" overall
Diameter: 6"
 - b. **Color:** Provide manufacturers color options for approval
3. Acceptable substitutes by one of the following:

- a. BRP Enterprises, Inc.
 - b. Canterbury International.
 - c. Columbia Cascade Company.
 - d. Creative Pipe, Inc.
 - e. Dero Bike Rack Co.
 - f. DuMor Inc.
 - g. FairWeather Site Furnishings; Division of Leader Manufacturing, Inc.
 - h. Huntco Supply, LLC.
 - i. Keystone Ridge Designs, Inc.
 - j. L. A. Steelcraft.
 - k. Maglin Site Furniture Inc.
 - l. Thomas Steele; Division of Trilary, Inc.
 - m. Urban Accessories, Inc.
- Victor Stanley, Inc.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211 (ASTM B 211M).
 2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 3. Structural Pipe and Tube: ASTM B 429/B 429M.
 4. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 5. Castings: ASTM B 26/B 26M.
- B. Steel and Iron: Free of surface blemishes and complying with the following:
1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
 2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
 3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
 4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
 5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
 6. Perforated Metal: From steel sheet not less than 0.075-inch (1.9-mm) nominal thickness; manufacturer's standard perforation pattern.
 7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
 8. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
 9. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.
- C. Stainless Steel: Free of surface blemishes and complying with the following:
1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
 2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.
 3. Tubing: ASTM A 554.

- D. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.
- E. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
 - 1. Polyethylene: Fabricated from virgin plastic HDPE resin.
- F. Anchors, Fasteners, Fittings, and Hardware: Galvanized steel; commercial quality, tamperproof, vandal and theft resistant.
- G. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.
- H. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
 - 1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. (0.27 kg/sq. m) of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil (0.0076 mm) thick.
 - 2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.
 - 3. warped or do not comply with requirements for untreated materials.

2.3 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.
- E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.4 FINISHES

- A. General: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Aluminum Finishes:
 - 1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- C. Steel and Galvanized-Steel Finishes:
 - 1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
 - 2. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.
- D. Iron Finishes:
 - 1. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- E. Stainless-Steel Finishes: Remove tool and die marks and stretch lines, or blend into finish.
 - 1. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run directional finishes with long dimension of each piece.
 - b. Directional Satin Finish: No 4.
 - c. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.
- D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

- E. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch (19 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

- F. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 32 3900

SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding.
2. Erosion-control material(s).
3. Watering seeded areas after installation
4. Stormwater seed mix

B. Related Sections:

1. Section 31 1000 "Site Clearing" for topsoil stripping and stockpiling.
Section 31 2000 "Earth Moving" for excavation, filling and backfilling, and rough grading

1.2 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Topsoil: Topsoil to be provided by contractor from off-site sources with the specified minimum quality specifications herein. Topsoil proposed for use to be processed and shall meet tested criteria results specified and conform to adjustments as recommended by the soil testing laboratory.
- F. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 INFORMATIONAL SUBMITTALS

- A. Soils analysis report with a list of soil amendments that will be added to soil to meet laboratory's recommendations.
- B. Source of topsoil
- C. Procedure to amend topsoil.
- D. Seed Mix.
- E. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
 - 1. Certification of each seed mixture for. Include identification of source and name and telephone number of supplier.
- F. Qualification Data: For qualified landscape Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
- B. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - 1. Report suitability of tested soil for turf growth including soil's ph.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.6 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin watering and maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue watering and maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species for non-athletic areas: State-certified seed of grass species as follows:
 1. Sun and Partial Shade: Proportioned by weight as follows:
 - a. 30 percent Kentucky Bluegrass 98/80
 - b. 25 percent Creeping Red Fescue
 - c. 25 percent Turf Type Perennial Rye
 - d. 10 percent Baron Kentucky Bluegrass
 - e. 10 percent Park Kentucky Bluegrass
- C. Seed Species for athletic field: State-certified seed of grass species as follows:
 1. Rhino Seed Premium Sports 80/20 mix
 2. 20 percent each of Elite Kentucky Bluegrass types
 3. 20 percent Turf Type Perennial Rye Grass

2.2 STORMWATER SEED MIX

A. SEED

1. Cardno Standard Stormwater Seed Mix:
 - a. A wetland seed mix for saturated soils in a detention pond or for seeding a saturated basin, this mix will tolerate highly fluctuating water levels and poor water quality associated with urban stormwater wetlands and ponds. For detention basins that experience long, dry periods, use the Economy Prairie seed mix in the upper third to half of the basin area in combination with this mix. This seed mix includes at least 10 of 12 native permanent grass, sedge, or rush species and 13 of 17 native forb species. Apply at 36.22 PLS pounds per acre. Prepare, install seed and maintain per Cardno Installation and Maintenance Guidelines.
 - b. Species Include:

<u>Botanical Name</u>	<u>Common Name</u>	<u>PLS Ounces/Acre</u>
Permanent Grasses/Sedges/Rushes:		
<i>Bolboschoenus fluviatilis</i>	River Bulrush	1.00
<i>Carex cristatella</i>	Crested Oval Sedge	0.50
<i>Carex lurida</i>	Bottlebrush Sedge	3.00

<i>Carex vulpinoidea</i>	Brown Fox Sedge	2.00
<i>Elymus virginicus</i>	Virginia Wild Rye	24.00
<i>Glyceria striata</i>	Fowl Manna Grass	1.00
<i>Juncus effusus</i>	Common Rush	1.00
<i>Leersia oryzoides</i>	Rice Cut Grass	1.00
<i>Panicum virgatum</i>	Switch Grass	2.00
<i>Schoenoplectus tabernaemontani</i>	Great Bulrush	3.00
<i>Scirpus atrovirens</i>	Dark Green Rush	2.00
<i>Scirpus cyperinus</i>	Wool Grass	1.00
	Total	41.50

Temporary Cover:

<i>Avena sativa</i>	Common Oat	512.00
	Total	512.00

Forbs & Shrubs:

<i>Alisma subcordatum</i>	Common Water Plantain	2.50
<i>Asclepias incarnata</i>	Swamp Milkweed	2.00
<i>Bidens spp.</i>	Bidens Species	2.00
<i>Eupatorium perfoliatum</i>	Common Boneset	1.00
<i>Helenium autumnale</i>	Sneezeweed	2.00
<i>Iris virginica v. shrevei</i>	Blue Flag	4.00
<i>Lycopus americanus</i>	Common Water Horehound	0.50
<i>Mimulus ringens</i>	Monkey Flower	1.00
<i>Penthorum sedoides</i>	Ditch Stonecrop	0.50
<i>Persicaria spp.</i>	Pinkweed Species	2.00
<i>Rudbeckia subtomentosa</i>	Sweet Black-Eyed Susan	1.00
<i>Rudbeckia triloba</i>	Brown-Eyed Susan	1.50
<i>Sagittaria latifolia</i>	Common Arrowhead	1.00
<i>Senna hebecarpa</i>	Wild Senna	2.00
<i>Symphotrichum lanceolatum</i>	Panicled Aster	0.50
<i>Symphotrichum novae-angliae</i>	New England Aster	0.50
<i>Thalictrum dasycarpum</i>	Purple Meadow Rue	2.00
	Total	26.00

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch(19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

- B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

- A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft.(0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium, by weight. Or as recommended by soil testing lab.

2.5 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content Existing, in-place surface , or imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with amendments and fertilizers
- B. ASTM D 5268 topsoil from the top surface horizon layer.
- C. Topsoil shall have a pH range of 5.5 to 7.5, adjusted to not more than 7.0 by additives as required by soils test.
- D. Topsoil shall be not less than 2% and not greater than 5% native organic matter, not compost material, as determined by a loss by ignition test at 360 degrees C.
- E. Topsoil to have a soil textural classification of Sandy Loam.
- F. Topsoil clay content as determined by Bouyoucous Hydrometer Test shall range between 5% and 20%
- G. Topsoil sand content shall be not less than 40% and not greater than 80%, as determined by a mechanical analysis.

2.6 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch(25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
- C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.7 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches(200 mm). Remove stones larger than 2 inches(50 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 2. Spread planting soil to a depth of 6 inches(150 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches(150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches(150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer directly to surface soil before loosening.
 - 3. Remove stones larger than 2 inches(50 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch(13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph(8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.(2.3 to 3.6 kg/92.9 sq. m).
- C. Rake seed lightly into top 1/8 inch(3 mm) of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas from hot, dry weather or drying winds by applying straw mulch or hydromulch within 4 hours after completing seeding operations. Scatter straw mulch uniformly to a minimum thickness of 1-1/2 inches(33 mm) to form a continuous blanket. Spread by hand, blower, or other suitable equipment. Water mulch immediately after spreading.

3.3 TURF WATERING AND MAINTENANCE

- A. Provide automatic temporary irrigation system to water turf lawn areas. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Watering: Install and maintain temporary irrigation piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 - 2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- C. Watering: Install and maintain temporary irrigation piping, hoses, and meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

3.5 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft.(0.92 sq. m) and bare spots not exceeding 5 by 5 inches(125 by 125 mm).
- B. Use specified materials to reestablish turf that does not comply with requirements and continue watering and maintenance until turf is satisfactory.

END OF SECTION 32 9200

SECTION 32 9300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils.
3. Tree stabilization.
4. Landscape edgings.
5. Tree grates.

B. Related Sections:

1. Section 01 5639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 31 2000 "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Section 32 9200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.2 ALLOWANCES

A. Allowances for plants are specified in Section 01 2100 "Allowances."

B. If using quantity allowances, retain three subparagraphs below or include similar language in Section 01 2100 "Allowances."

1. Perform planting work under quantity allowances and only as authorized. Authorized work includes work required by Drawings and the Specifications and work authorized in writing by Architect.
2. Notify Architect weekly of extent of work performed that is attributable to quantity allowances.
3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

C. Furnish trees as part of tree allowance.

D. Furnish <Insert plant variety> as part of <Insert name of allowance>.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 01 2200 "Unit Prices."

1. Unit prices apply to authorized work covered by quantity allowances.
2. Unit prices apply to additions to and deletions from Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- F. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- G. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- H. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- I. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- J. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- K. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
- B. Samples of mineral mulch.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer.
- B. Product certificates.

- C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
 - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 - 2. Experience: Five years' experience in landscape installation in addition to requirements in Section 01 4000 "Quality Requirements."
 - 3. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - 1. The soil-testing laboratory shall oversee soil sampling.
 - 2. Report suitability of tested soil for plant growth.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
- D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
 - 1. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.
- E. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie

trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

- D. Handle planting stock by root ball.
- E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.
- F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1.9 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods from Date of Planting Completion:
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period for Trees and Shrubs: Three months from date of planting completion.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

- B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- C. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 INORGANIC SOIL AMENDMENTS

- A. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.3 ORGANIC SOIL AMENDMENTS

- A. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

2.4 FERTILIZERS

- 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- B. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
 - 1. Size: 21-gram tablets.
 - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

- A. Planting Soil (): ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content. Imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with the following soil amendments in the following quantities to produce planting soil:
 - 1. Ratio of Loose Compost to Topsoil by Volume: 1:3.

2.6 MULCHES

- A. Organic Mulch: Shredded hardwood.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of [2 to 5] <Insert range or value> decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

2.7 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.8 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Proprietary Staking-and-Guying Devices: Proprietary stake and adjustable tie systems to secure each new planting by plant stem; sized as indicated and per manufacturer's written recommendations.

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball; sized per manufacturer's written recommendations unless otherwise indicated.

C. Palm Bracing: Battens or blocks, struts, straps, and protective padding as indicated.

1. Battens or Blocks and Struts: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-4-inch nominal (38-by-89-mm actual) by lengths indicated.
2. Straps: Adjustable steel or plastic package banding straps.
3. Padding: Burlap.
4. Proprietary Palm-Bracing Devices: Proprietary systems to secure each new planting by trunk; sized per manufacturer's written recommendations unless otherwise indicated.

2.9 LANDSCAPE EDGINGS

A. Wood Edging: Of sizes shown on Drawings, and wood stakes as follows:

1. Species: [Western red cedar, all heart] [Southern pine with specified wood pressure-preservative treatment].
2. Stakes: Same species as edging, 1-by-2-inch nominal (19-by-38-mm actual) by 18 inches (450 mm) long, with galvanized nails for anchoring edging.

B. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. Border Concepts, Inc.
 - b. Collier Metal Specialties, Inc.
 - c. Russell, J. D. Company (The).
 - d. Sure-Loc Edging Corporation.
 - e. <Insert manufacturer's name>.
 3. Edging SizeAs indicated on drawings.
 4. Stakes: Tapered steel, a minimum of 15 inches (380 mm) long.
 5. Accessories: Standard tapered ends, corners, and splicers.
 6. Finish: [Standard paint] [Zinc coated] [Unfinished].
 7. Paint Color: Black.
- C. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221 (ASTM B 221M), Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 3. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Curv-Rite, Inc.
 - b. Permaloc Corporation.
 - c. Russell, J. D. Company (The).
 - d. Sure-Loc Edging Corporation.
 4. Edging Size: 3/16 inch (4.8 mm) wide by 4 inches (100 mm) deep.
 5. Edging Size: As indicated on drawings.
 6. Stakes: As indicated on drawings.
 7. Finish: Black anodized.
 8. Finish: Manufacturer's standard paint.
 9. Paint Color: Black.

2.10 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.
- B. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils (2.2 mm) thick, with vertical root deflecting ribs protruding 3/4 inch (19 mm) out from panel, and each panel 18 inches (457 mm) wide.

- C. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.
- D. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 6 inches (150 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply superphosphate fertilizer directly to subgrade before loosening.
 - 2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 3. Spread planting soil to a depth of 8 inches (200 mm) but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.2 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter.
 - 2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
- B. Subsoil and topsoil removed from excavations may not be used as planting soil.

3.3 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set stock plumb and in center of planting pit or trench with root flare 2 inches (50 mm) above adjacent finish grades.

- D. Set stock plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
1. Use planting soil for backfill.
 2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 3. Balled and Potted and Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
 4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 5. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 6. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 7. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Bare-Root Stock: Set and support bare-root stock in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grade.
1. Use planting soil for backfill.
 2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling, and maintain plumb while working backfill around roots and placing layers above roots.
 3. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole or touching the roots.
 4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.4 MECHANIZED TREE SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- C. Cut exposed roots cleanly during transplanting operations.
- D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

- E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.
- F. Where possible, orient the tree in the same direction as in its original location.

3.5 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

3.6 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.7 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 12 inches (300 mm) and secure seams with galvanized pins.
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch (75-mm) average thickness, with 36-inch (900-mm) radius around trunks or stems. Do not place mulch within 6 inches (150 mm) of trunks or stems.
 - 2. Organic Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 6 inches (150 mm) of trunks or stems.

3.8 EDGING INSTALLATION

- A. Wood Edging: Install edging where indicated. Mitre cut joints and connections at a 45 degree angle. Fasten each cut joint or connection with two galvanized nails. Anchor with wood stakes spaced up to 36 inches (900 mm) apart, driven at least 1 inch (25 mm) below top elevation of edging. Use two galvanized nails per stake to fasten edging, of length as needed to penetrate both edging and stake and provide 1/2-inch (13-mm) clinch at point. Predrill stakes if needed to avoid splitting. Replace stakes that crack or split during installation process.
- B. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.
- C. Aluminum Edging: Install aluminum edging where indicated according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches (900 mm) apart, driven below top elevation of edging.
- D. Plastic Edging: Install plastic edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately **[36 inches (900 mm)] [48 inches (1200 mm)]** apart, driven through upper base grooves or V-lip of edging.

3.9 TREE GRATE INSTALLATION

- A. Tree Grates: Set grate segments flush with adjoining surfaces as shown on Drawings. Shim from supporting substrate with soil-resistant plastic. Maintain a 3-inch- (75-mm-) minimum growth radius around base of tree; break away units of casting, if necessary, according to manufacturer's written instructions.

3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- E. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT

PLANTS
32 9300 - 12
12/21/2022

END OF SECTION 32 9300

SECTION 33 0100 – EXCAVATING, TRENCHING & BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. The work shall consist of furnishing all materials, equipment, and labor for excavating, trenching, and backfilling for utilities. The work also shall include the necessary clearing, sheeting and shoring, boring and jacking, dewatering, pipe embedment, and other appurtenant work.
- B. The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction.

PART 2 - EXISTING SOIL/SUBSURFACE CONDITIONS

2.1 GENERAL

- A. Where provided, soil borings are shown on the drawings only as information for use by the engineer in preparing the contract documents. The Contractor is solely responsible for confirming actual soil conditions and depth of the water table.

PART 3 - EXISTING UNDERGROUND UTILITIES & STRUCTURES

3.1 LOCATION

- A. No less than three (3) working days prior to excavating, the Contractor is to call "MISS DIG" at 811 (1-800-482-7171). Existing utilities are shown only at their approximate locations. The Contractor shall be responsible for determining their exact elevations and location in the field. The Contractor shall notify the owners of all underground utilities before starting any work. House sewer connections, water and gas services, and other utility lines may not be indicated on the drawings. However, the Contractor shall make every effort to locate all underground utilities from information obtained from the utility owner or by prospecting in advance of trench excavation.

3.2 PROTECTION OF UTILITIES

- A. The Contractor shall furnish, install, use, and maintain adequate sheeting, shoring, bracing, and stabilization methods required to insure the integrity of existing underground utilities both during and after completion of construction. When necessary, the Contractor shall shore and brace existing utility poles which interfere with construction. The Contractor shall be responsible for repairing all cracks, leaks, breaks, and defects in the utilities during the standard contract guarantee period of one year after acceptance of construction, at no additional cost either to the project owner or the owner of the utility. Should service provided by public utilities be interrupted by the Contractor, the Contractor shall be responsible for returning all public utilities to normal working order. Cost for complying with this specification shall be included in major items of work in the proposal. Therefore, no additional payment for these items shall be made.

- B. When necessary, the Contractor shall shore and brace utility poles that interfere with construction. Shoring and bracing shall be such that sinking or excessive tilting does not take place. All relocation or removing and replacing of power poles, light poles and telephone poles shall be done in accordance with Utility Owners Standards and all expenses shall be paid for by the Contractor. All arrangements for relocations with the Utility Company Owners shall be done by the Contractor at least 72 hours prior to need for relocations.

3.3 REPLACEMENT

- A. Certain underground utilities such as sewers may require removal and subsequent replacement in lieu of supporting or bracing during the proposed construction, or the Contractor may elect this option when temporary provisions to maintain essential services have been previously approved by the Construction Manager.
- B. Unless otherwise specified, any utilities removed during the proposed construction shall be replaced by the Contractor. Materials and installation shall be equal to or better than original construction in every way. Salvaged materials may be reused when they are in good condition, and a satisfactory installation can be accomplished in the judgment of the Engineer.
- C. Replacement of existing utilities shall be considered incidental to the major items of work unless specific items have been provided in the Proposal, in which case the prices bid shall be payment in full for performing this work as specified herein.

3.4 RELOCATION

- A. Should any pipe or other existing utility require raising or lowering or moving to another location because of interference with the pipe or structure being constructed under these specifications, such changes which in the opinion of the Engineer are necessary shall be made by the Contractor unless otherwise specified. This work will be paid for separately under the appropriate contract items or under the contract provisions for extra work.

3.5 RECONNECTION

- A. Where lateral services, house connections, or other pipe lines require reconnection to the proposed utility, as is the case when an existing utility is being reconstructed, the Contractor shall make these connections as specified or as shown on the drawings. All costs for making these connections, including provisions for maintaining flows and providing temporary service during the proposed construction, shall be incidental to the installation of the pipe unless specific items are provided in the Proposal.

3.6 UTILITIES TO BE ABANDONED

- A. When pipes, conduits, sewers, or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and mortar by the Contractor. Abandoned structures such as manholes or chambers shall be entirely removed unless otherwise specified or shown on the drawings.
- B. All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation by the Contractor and stored on the site or loaded on the Owner's truck as directed by the Construction

Manager. Owner shall have first claim to salvageable materials. The Contractor is responsible to dispose of salvageable materials not desired to be kept by the Owner.

- C. All costs for abandoning utilities and for removing and salvaging materials, when required, shall be considered included in the major items of work unless specific items have been provided in the Proposal in which case the prices bid shall be payment in full for performing this work as specified herein.

PART 4 - EXCAVATING & TRENCHING

4.1 GENERAL

- A. Excavating and trenching operations shall at all times be conducted in a safe, orderly manner using methods and equipment designed and suited to the intended use by personnel experienced in the work being performed.
- B. None of the requirements or provisions specified herein or shown on the drawings shall nullify or restrict any safety provisions required by any regulation or law governing the protection and/or safety of persons or property.

4.2 WIDTH OF TRENCH

- A. The width of the trench shall be ample to permit the pipe to be laid and joined properly and the pipe embedment material and backfill to be placed and compacted as specified. Trenches shall be of sufficient extra width when required as will permit the convenient placing of trench supports, sheeting, and bracing.

1. Width of Trench for Rigid Pipe

- a. In order to limit excessive loads on rigid pipe, the maximum width of trench for pipe 36 inches and larger in diameter shall not be more than twice the nominal diameter; for smaller sizes of pipe, the maximum width of trench shall be not more than 3 feet greater than the nominal diameter of the pipe except as otherwise specified or directed. The above limiting restrictions on trench width apply from outside bottom of pipe to outside top of pipe.
- b. Where the width of trench within these limits exceeds the maximum limit specified, the Contractor shall install a heavier class of pipe or use other means to provide additional load-carrying capacity at no additional cost to the Owner. Any changes in class of pipe or other variation shall be approved in writing by the Construction Manager before the work progresses.
- c. When the trench width above the top of the pipe is appreciably greater than that which is reasonably required by project conditions in the judgment of the Engineer, any additional cost for backfill material, surface restoration, or other items that are the result of such excess width shall be borne by the Contractor.

2. Width of Trench for Flexible Pipe

- a. Unless otherwise specified or approved by the Engineer, a minimum trench width of at least two (2) feet on each side of the pipe for placement of select embedment material will be required.

4.3 EXCAVATING TO GRADE

- A. The trench shall be excavated to a depth required for the proper installation of the pipe and placing of the pipe embedment material as specified.
- B. Any part of the bottom of the trench excavated below the specified subgrade shall be refilled with approved materials compacted to 95% of maximum unit weight in accordance with MDOT procedures at no additional cost to the Owner. If additional excavation is required to correct unstable foundation conditions, payment will be made as specified in Section 2.08.

4.4 SHEETING, SHORING, BRACING, & SHELVING

- A. The Contractor shall brace or slope back the sides of all excavations in accordance with current MIOSHA and OSHA regulations. The Contractor shall be responsible for compliance to such regulations and for the design, installation, and maintenance of all excavation safety measures.

4.5 DEWATERING

- A. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water including water or sewage from exposed sewers or water mains, from all excavations and trenches, or other parts of the work. Each excavation shall be kept dry during the preparation of the subgrade and continually thereafter until the structure to be built or the installation of the pipe line is completed to such extent that no damage from hydrostatic pressure, flotation, or other cause will result.
- B. Where work is in soil containing an excessive amount of water, the Contractor shall provide, install, and maintain suitable well points or wells connected to manifolds or reliable pumping equipment, or other suitable dewatering methods, and shall so operate the dewatering system to insure proper construction of the work. If the Contractor elects to use a trench underdrain or similar dewatering system, he shall receive prior approval of the Construction Manager as to location and installation methods for this type of system. The Contractor shall make every effort to prevent sand, sediment, or debris from entering any existing pipe line or conduit which he may use for drainage purposes. The repair or cleaning of drainage structures made necessary by the Contractor's operations shall be performed by and at the expense of the Contractor. Arrangements for discharge of ground water into any public sewer shall be previously approved by the Engineer.
- C. Dewatering including the use of stone or gravel for dewatering purposes when required will not be paid for separately but shall be included in the contract price for the major items of work.
- D. The Contractor shall limit his dewatering operation to the minimum time and depth required for construction. The Contractor will be required to furnish temporary water service and/or provide potable water at the direction of the Construction Manager to property owners whose wells are affected by the dewatering operations.

PART 5 - SUBGRADE

5.1 GENERAL

- A. The subgrade for pipe and/or structures shall be firm, dense, and thoroughly compacted and consolidated, free from mud and muck, and sufficiently stable to remain firm and intact under the feet of the workmen.

5.2 UNSTABLE FOUNDATION

- A. When the soil beneath the normal pipe embedment area is soft or unstable, even with adequate dewatering, or in the opinion of the Engineer cannot support the pipe or utility, further depth shall be excavated and refilled to the proposed grade MDOT Class II granular material (for plastic pipe the material must comply with ASTM D2321 compacted in twelve (12) inch layers as specified in Section 2.09.05, or other approved means shall be employed to assure a firm foundation for the utility. The volume of unstable foundation removed and replaced with approved materials for which payment will be allowed shall be determined in cubic yards unless otherwise specified on the drawing or in the proposal. Said volume to be computed by assuming that the cross section area of the unstable foundation takes the form of a trapezoid as shown on the Standard Detail for Unstable Soil Removal for Utility.
- B. Payment for removal and replacement of unstable foundation will be paid under the contract provisions for extra work, unless specific Proposal items have been provided, in which case, the unit price bid shall be payment in full for performing the work as specified. If the soil in the bottom of trench is soft due to excessive amounts of ground water, and/or the Contractor's method of operation, stabilization of the trench bottom shall be at the Contractor's expense.

5.3 SPECIAL FOUNDATIONS

- A. Where the subgrade at the bottom of the excavation consists of soil which is unstable or yielding to such a degree that, in the opinion of the Engineer, it cannot properly support the pipe or structure, the Contractor shall construct such additional foundation or reinforcement of the subgrade as may be specified, such as timber piling, geotextiles, or other means as approved by the Engineer to provide a proper foundation.
- B. The construction of special foundations will be paid for separately based on the contract provisions for extra work, unless specific Proposal items have been provided, in which case the unit price bid shall be payment in full for performing the work as specified.

PART 6 - PIPE EMBEDMENT

6.1 GENERAL

- A. Pipe embedment shall include the furnishing and placing of approved materials as specified or as directed from 4 inches under the outside bottom of the pipe to 12 inches over the outside top of the pipe. Various classes of pipe embedment may be specified or shown on the Drawings or Standard details in which case the limits of the various types will also be specified.

6.2 FLEXIBLE PIPE EMBEDMENT

- A. Flexible pipe is any pipe having a pipe stiffness of less than 60 psi. as defined under the requirements of ASTM Designation D-2412 (this includes all plastic pipe except Composite (Truss) pipe, and may include corrugated metal pipe, ductile iron pipe, and steel pipe, depending on pipe diameter and wall thickness).
- B. Pipe embedment for flexible pipe shall be Class B. For pipes less than fifteen (15) inches in diameter, bedding material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for granular materials Class II, modified to 100% passing a 1" sieve shall be used. If stone is used for bedding, it shall meet the requirements of ASTM D2321 (Table 1) for Class 1A crushed stone. An Engineer approved geotextile filter fabric shall be placed around all areas where Class 1A crushed stone pipe embedment is used as shown on the Standard details. Transition zones between crushed stone and sand embedment shall be separated by a geotextile fabric. For pipes fifteen (15) inches in diameter and larger, bedding material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for granular materials Class II, modified to 100% passing a 1" sieve shall be used.

6.3 CLASS B PIPE EMBEDMENT

- A. Unless otherwise specified or shown on the Drawings, all pipe embedment shall be Class B pipe embedment as shown on the Standard details. When the soil in the bottom of the trench at pipe subgrade meets all the requirements for Granular Material Class II as specified in the MDOT 2020 Standard Specifications for Construction, Section 902.07 and in the opinion of the Engineer will provide suitable bedding for the pipe, such soil may be utilized as bedding material and prepared to receive the pipe as specified without undercutting and subsequent replacement.
- B. Plastic pipe embedment shall comply with ASTM D2321.

6.4 SPECIAL PIPE EMBEDMENT

- A. Various types of special pipe embedment may be specified or shown on the Drawings in locations where special conditions require their use.
- B. The Contractor shall perform all the work of constructing special pipe embedment where specified.

6.5 PLACING PIPE EMBEDMENT MATERIAL

- A. Pipe embedment material shall be placed in the bottom of the trench and shaped by hand to provide a firm and uniform bearing for the barrel of the pipe with additional shaping to accommodate the bells on bell and spigot pipe.
- B. After each pipe has been graded, aligned, and placed in final position on the bedding material and jointing is complete, additional embedment material shall be carefully placed and compacted under and around each side of the pipe and over the pipe until it is completely covered by 12 inches of embedment material. Said material shall be distributed along both sides of the pipe uniformly and simultaneously to prevent lateral displacement of the pipe. All granular embedment material shall be compacted to 95% of maximum unit weight in accordance with MDOT procedures.

- C. All the work of placing pipe embedment shall be considered an integral part of installing the pipe and shall be completed immediately after the pipe is laid to the correct alignment and grade.

PART 7 - BACKFILLING ABOVE PIPE EMBEDMENT

7.1 GENERAL

- A. All backfill material shall be free from cinders, ashes, refuse, sod, organic material, boulders, or rocks larger than 12 inches in diameter, frozen material or other material which in the opinion of the Engineer is unsuitable. The soil excavated from the trenches shall be used for backfilling when it is classified as suitable by the Engineer. If all or a portion of the excavated material is classified as unsuitable for backfilling, the Contractor shall remove and dispose of the unsuitable material and shall furnish and place granular material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for Granular Material Class II.
- B. All backfilling and compaction shall be performed by the Contractor using methods and equipment approved by the Engineer.

7.2 TRENCHES REQUIRING COMPACTED GRANULAR BACKFILL

- A. Trenches and excavations in the following locations shall be backfilled with approved native granular material:
 - 1. Improved areas, including drives, sidewalks, parking areas, around structures, etc.
 - 2. Within the limits of the roadway (within a 1 on 1 slope beginning two (2) feet from the edge of pavement or back of curb towards the right-of-way line).
 - 3. Within the limits of future improvements (shown on Drawings).
 - 4. Within limits specified on Drawings.
 - 5. All sanitary sewer lateral trenches within the limits of the right-of-way.
- B. All backfilling shall be completed with native material. All backfill within these areas shall be placed in layers not exceeding twelve (12) inches thick, and shall be compacted to 95% of maximum unit weight in accordance with MDOT procedures. Tests for compaction will be made by the Construction Manager or other representative designated by the Construction Manager at no cost to the contractor. When tests indicate a density which is less than that required, the methods or equipment being used shall be modified to obtain the density specified, and the section in question shall be re-compacted until the required density is obtained. The cost of retesting shall be borne by the Contractor.

7.3 TRENCHES NOT REQUIREING COMPACTED GRANULAR BACKFILL

- A. Where not otherwise specified or directed, backfilling above the pipe embedment shall be made with material which is originally excavated, which is suitable. Backfill materials shall be consolidated by mechanical equipment working longitudinally in the trench, or by other approved methods, so as to be free

of large voids with any excess material mounded over the trench or removed as directed by the Construction Manager. The trench shall be graded to a reasonable uniformity and left in a neat condition.

- B. The backfill shall be sufficiently compacted so settlement does not occur. The Contractor shall repair any settlement (including topsoil, seed, fertilizer and mulch) should any occur within one (1) year following completion of the project.

PART 8 - SPECIAL BACKFILL - MEASUREMENT AND PAYMENT

8.1 MEASUREMENT

- A. When an item has been provided in the Proposal for special backfill, approved granular material obtained off the site which is required by these specifications or authorized by the Construction Manager shall be included in this item. Special backfill shall be measured compacted in place. The Contractor shall furnish a delivery ticket for each truck load at the time the material is delivered to the project. The delivery ticket shall be prepared at least in duplicate, one copy of which shall be furnished to the Construction Manager or his representative, the other copy to be retained in the Contractor's file. No payment shall be made for special backfill unless the individual truck delivery tickets are furnished in this manner. The Construction Manager will use the delivery tickets when calculating the compacted in place quantity.
- B. Stone used specifically for dewatering procedures shall not be classified as special backfill and no specific payment will be made therefore.

PART 9 - LIMITATIONS ON OPERATIONS

9.1 GENERAL

- A. The Contractor shall at all times conduct his work so that there is a minimum of inconvenience to the residents and businesses in the vicinity of this project. To this end, he shall complete his backfill and remove all debris and unsuitable backfill to a point as close to the actual pipe installation as is practical and keep the area where the pipe construction and backfill has been completed in a neat condition. Open excavations shall be protected by signs, lights, barricades, and/or fence at all times when work is not actually taking place at that excavation. The placement of excavated earth along the line of the trench shall be controlled by the use made of the street or right-of-way by the public and shall always be confined to approved limits.

END OF SECTION 33 0100

SECTION 33 2150 – FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.
- C. The Contractor shall coordinate with the Owner for the installation of the domestic water / fire service line to the building.
- D. The work shall consist of furnishing and installing a water main and fire service of the specified size or sizes at the depths shown on the drawings or specified herein, and furnishing all fittings and joint material, labor, materials, tools, and equipment for receiving, unloading, transporting, laying, testing, and disinfecting of water pipe and fittings. Contractor shall furnish all materials, valves, valve boxes and other necessary accessories to complete the pipe work as shown on the drawings and specified herein. Excavating, trenching and backfilling shall be as specified in Section 33 0100.
- E. The work shall be performed in accordance with the specifications and drawings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Water main shall comply with all requirements laid out by municipality supplying water
 - 2. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 3. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 4. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

- D. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- F. NSF Compliance:
 - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than seven (7) days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Architect and Owner's written permission.

1.5 COORDINATION

- A. Coordinate reconnection to water main with utility the Department of Corrections.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Glands, Gaskets, and Bolts: AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.

2.2 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.3 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - b. East Jordan Iron Works, Inc.
 - c. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - d. Mueller Co.; Water Products Div.
2. Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - b. East Jordan Iron Works, Inc.
 - c. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - d. Mueller Co.; Water Products Div.
2. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, ductile iron-seated gate valve with one raised face flange mating tapping-sleeve flange.

- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
 - 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.5 CORPORATION VALVES

- A. Manufacturers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ford Meter Box Company, Inc. (The); Pipe Products Div.
 - b. Master Meter, Inc.
 - c. McDonald, A. Y. Mfg. Co.
 - d. Mueller Co.; Water Products Div.
 - e. Red Hed Manufacturing & Supply.
- B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.
 - 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
 - 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
 - 3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
- C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
- D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
 - 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.6 BACKFLOW PREVENTERS

- A. Backflow preventers to be coordinated with the Architectural Plumbing plans.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 33 "Earthwork" and "Excavating, trenching, and backfilling for Utilities".

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B88 Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 and NPS 6 shall be the following:
 - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed; mechanical-joint pipe; ductile-iron, mechanical-joint fittings, and mechanical joints.
- G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, seated gate valves with valve box.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- B. Comply with NFPA 24 for fire-service-main piping materials and installation.
 - 1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- D. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- F. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration.
- G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- H. Sleeves are specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- I. Mechanical sleeve seals are specified in Division 15 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.6 JOINT CONSTRUCTION

- A. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
 - 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

4. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Piped Utilities - Basic Materials and Methods" for joining piping of dissimilar metals.

3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 1. Concrete thrust blocks.
 2. Locking mechanical joints.
 3. Set-screw mechanical retainer glands.
 4. Bolted flanged joints.
 5. Heat-fused joints.
 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.9 WATER METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written instructions.

3.10 BACKFLOW PREVENTER INSTALLATION

- A. Refer to AE Plumbing plans

3.11 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping connections to valves and equipment.
- C. Connect water-distribution piping to utility water main or existing water main. Use tapping sleeve and tapping valve or service clamp and corporation valve.
- D. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.13 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Have water samples tested by an independent laboratory for a biological examination. Repeat procedure if biological examination shows evidence of contamination.

**PROJECT NO. 21113.10 & 21113.20
HEMLOCK AND K.C. LING ELEMENTARIES
HEMLOCK PUBLIC SCHOOL DISTRICT**

**FACILITY WATER
33 2150 - 9
12/21/2022**

- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 33 2150

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SECTION 33 4100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For underground structures. Include plans, elevations, sections, details, and frames, covers, and grates.
- C. Field quality-control test reports.

1.3 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76(ASTM C76M), Class III, with bell-and-spigot ends, and gasketed joints with ASTM C 443(ASTM C 443M), rubber gaskets.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

- A. Description: Cast-iron cleanout with threaded adjustable housing, flanged ferrule, brass cleanout plug, and round cast-iron heavy-duty, secured, scoriated cover. Wade Model 6000Z-75-179 or equivalent.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB Manufacturing Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Wade Div.; Tyler Pipe.
 - e. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.7 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 5. Top Section: Eccentric-cone type unless flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Individual FRP steps, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

10. Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

2.8 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.9 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 5. Top Section: Eccentric-cone type unless flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Individual FRP steps, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
 10. Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange. Provide grates as indicated on drawings.
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

2.10 DRAIN INLETS

- A. Precast Concrete Catch Basins: ASTM C 76, precast reinforced concrete sewer pipe, of depth indicated. Base section shall have minimum thickness of 4-inches, riser sections shall have minimum thickness of 3 inches and be 24 inches inside diameter.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18 heavy-duty, ductile-iron, sewer pipe bell flange. Refer to drawings for cover types.

2.11 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - 1. Average Size: NSSGA No. R-5, screen opening 5 inches.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, backfilling, and warning tapes are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
- B. Gravity-Flow, Nonpressure Sewer Piping: Refer to plans for materials:

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping below frost line.
 - 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 4. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.4 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1/8" inch above surrounding grade.
- C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops as indicated on the plans.

3.7 CATCH BASIN INSTALLATION

- A. General: Install catch basins, complete with appurtenances and accessories indicated.
- B. Install precast concrete sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers at elevations indicated.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22.
- B. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work and with municipal storm system requirements.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 4100

SECTION 33 4600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes subdrainage systems for foundations, retaining walls, and landscaped areas.
- B. Related Sections include the following:
 - 1. Division 07 waterproofing Sections for molded-sheet drainage panels.

1.2 SUBMITTALS

- A. Product Data: For each type of drainage panel indicated.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.
- B. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.
- C. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal.

2.4 SPECIAL PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.
- B. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
 - 1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
 - 2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
- B. Underslab Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

- C. Header Piping:
 - 1. PE drainage tubing and fittings, couplings, and coupled joints.
 - 2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 - 1. At Grade in Earth: PVC cleanouts.
 - 2. At Grade in Paved Areas: Cast-iron cleanouts.
- B. In Underslab Subdrainage Piping:
 - 1. In Equipment Rooms and Unfinished Areas: Cast-iron cleanouts.
 - 2. In Finished Areas: Copper-alloy cleanouts.

3.4 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and 6 inches above top of pipe and extend to cover minimum 6 inches of bottom of drainage panel.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

3.5 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and

trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- F. Add drainage course to width of at least 6 inches on both sides and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.6 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.8 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 42 inches, unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
 - 3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow 36 inches unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
 - 4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
 - 5. Lay perforated pipe with perforations down.
 - 6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.
- D. Install PVC piping according to ASTM D 2321.

3.9 PIPE JOINT CONSTRUCTION

- A. Cast-Iron Soil Pipe and Fittings: Hub and spigot, with rubber compression gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.
- B. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- C. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- D. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- E. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- F. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.10 CLEANOUT INSTALLATION

- A. Cleanouts for Foundation Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
 - 3. In nonvehicular-traffic areas, use PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.
- B. Cleanouts for Underslab Subdrainage:
 - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

3.12 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.14 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 4600

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TABLE OF CONTENTS

Refer to Construction Manager's Project Manual issued by Construction Manager for additional procurement, contracting, and general requirements

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

- 00 1113 - ADVERTISEMENT FOR BIDS
- 00 1116 - INVITATION TO BID
- 00 2113 - INSTRUCTIONS TO BIDDERS
- 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES
- 00 3100 - AVAILABLE PROJECT INFORMATION
- 00 4100 - BID FORM
- 00 4325 - SUBSTITUTION DURING PROCUREMENT REQUEST FORM
- 00 4518 - FAMILIAL STATEMENT OF DISCLOSURE
- 00 4519 - NONCOLLUSION AFFIDAVIT
- 00 4546 - GOVERNMENTAL CERTIFICATIONS
- 00 4553 - BIDDER'S CERTIFICATION REGARDING RESPONSIBILITY MATTERS
- 00 6323 - CADD FILE TRANSFER WAIVER
- 00 6324 - BIM TRANSFER WAIVER
- 00 6325 - SUBSTITUTION DURING CONSTRUCTION REQUEST FORM
- 00 7200 - GENERAL CONDITIONS
- 00 7300 - SUPPLEMENTARY CONDITIONS
- 00 7343 - WAGE RATE REQUIREMENTS

DIVISION 01 — GENERAL REQUIREMENTS

- 01 2200 - UNIT PRICES
- 01 2300 - ALTERNATES
- 01 2500 - SUBSTITUTION PROCEDURES
- 01 2600 - CONTRACT MODIFICATION PROCEDURES
- 01 2900 - PAYMENT PROCEDURES
- 01 3100 - PROJECT MANAGEMENT AND COORDINATION
- 01 3300 - SUBMITTAL PROCEDURES
- 01 4000 - QUALITY REQUIREMENTS
- 01 4200 - REFERENCES
- 01 5639 - TEMPORARY TREE AND PLANT PROTECTION
- 01 6000 - PRODUCT REQUIREMENTS
- 01 7300 - EXECUTION
- 01 7700 - CLOSEOUT PROCEDURES
- 01 7823 - OPERATION AND MAINTENANCE DATA
- 01 7839 - PROJECT RECORD DOCUMENTS
- 01 7900 - DEMONSTRATION AND TRAINING

DIVISION 02 — EXISTING CONDITIONS

- 02 4119 - SELECTIVE DEMOLITION

DIVISION 03 — CONCRETE

03 3000 - CAST-IN-PLACE CONCRETE

DIVISION 04 — MASONRY

NOT USED

DIVISION 05 — METALS

NOT USED

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

06 1000 - ROUGH CARPENTRY

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

NOT USED

DIVISION 08 — OPENINGS

NOT USED

DIVISION 09 — FINISHES

NOT USED

DIVISION 10 — SPECIALTIES

NOT USED

DIVISION 11 — EQUIPMENT

11 6800 - PLAY FIELD EQUIPMENT AND STRUCTURES

DIVISION 12 — FURNISHINGS

NOT USED

DIVISION 13 — SPECIAL CONSTRUCTION

NOT USED

DIVISION 14 — CONVEYING EQUIPMENT

NOT USED

DIVISION 21 — FIRE SUPPRESSION

NOT USED

DIVISION 22 — PLUMBING

NOT USED

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

NOT USED

DIVISION 25 — INTEGRATED AUTOMATION

NOT USED

DIVISION 26 — ELECTRICAL

- 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL
- 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
- 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

DIVISION 27 — COMMUNICATIONS

NOT USED

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

NOT USED

DIVISION 31 — EARTHWORK

- 31 1000 - SITE CLEARING
- 31 2000 - EARTH MOVING
- 31 2319 - DEWATERING

DIVISION 32 — EXTERIOR IMPROVEMENTS

- 32 1124 - AGGREGATE DRAINAGE LAYER
- 32 1216 - ASPHALT PAVING
- 32 1313 - CONCRETE PAVING
- 32 1373 - CONCRETE PAVING JOINT SEALANTS

32 1813 - SYNTHETIC GRASS SURFACING
32 1823.39 - SYNTHETIC RUNNING TRACK SURFACING
32 1852 - PERFORMANCE SHOCK PAD
32 8420 - WATER DISTRIBUTION SYSTEM
32 9200 - TURF AND GRASSES

DIVISION 33 — UTILITIES

33 4100 - STORM UTILITY DRAINAGE PIPING
33 4600 - SUBDRAINAGE
33 4605 - SUBDRAINAGE - FLAT DRAINTILE

DIVISION 34 — TRANSPORTATION

NOT USED

DIVISION 35 — WATERWAY AND MARINE

NOT USED

DIVISION 40 — PROCESS INTERCONNECTIONS

NOT USED

DIVISION 41 — MATERIAL PROCESSING AND HANDLING EQUIPMENT

NOT USED

DIVISION 42 — PROCESS HEATING, COOLING, AND DRYING EQUIPMENT

NOT USED

DIVISION 43 — PROCESS GAS AND LIQUID HANDLING, PURIFICATION AND STORAGE EQUIPMENT

NOT USED

DIVISION 44 — POLLUTION AND WASTE CONTROL EQUIPMENT

NOT USED

DIVISION 45 — INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

NOT USED

**PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT**

**TABLE OF CONTENTS
5
12/21/2022**

DIVISION 46 — WATER AND WASTEWATER EQUIPMENT

NOT USED

DIVISION 48 — ELECTRICAL POWER GENERATION

NOT USED

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SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

1.1 EXISTING REPORTS AND SURVEYS

A. SUBSURFACE INVESTIGATION REPORT

B. A copy of a geotechnical report with respect to the building site is available for viewing:

1. Title: Geotechnical Report, Hemlock Public Schools.
2. Date: September 28, 2022.
3. Prepared by: Spicer Group.

C. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the Architect.

D. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

E. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to the Owner.

F. The soil boring logs from this report are included with this document.

1.2 TOPOGRAPHIC SURVEY

A. A copy of a topographic survey with respect to the project site is available for viewing:

1. Title: Boundary, Topographic & Utility Survey for Hemlock Public Schools.
2. Date: September 23, 2022.
3. Prepared by: Spicer Group.

B. This survey identifies grade elevations prepared primarily for the use of the Architect in establishing new grades and identifying natural water shed.

1.3 EXISTING CONDITIONS SURVEY

A. A copy of a survey with respect to the condition of the existing construction is available for viewing:

1. Title: Three Year Asbestos Reinspection.
2. Date: July 12, 2022.
3. Prepared by: Fortress Environmental Solutions, LLC.

B. This survey identifies conditions of existing construction prepared primarily for the use of the owner for on-going operations.

END OF DOCUMENT 00 3100

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1.2 REQUESTER'S STATEMENT

A. I have reviewed the terms of this request and am in agreement with the conditions stated.

B. _____

C. Requester's signature

END OF DOCUMENT 00 6325

SECTION 00 6325 - SUBSTITUTION DURING CONSTRUCTION REQUEST FORM

1.1 INTRODUCTORY INFORMATION

- A. Date: _____
- B. Requesting substitution of _____
- C. As specified in Section _____
- D. Requested Substitute Product: _____

1.2 SUBMITTING PARTY'S STATEMENT

- A. Circle "Y" for yes and "N" for no for each of the following statements and submit supporting data. Indicate impact for all statements below answered as no, with supporting data:
 - 1. [Y] [N] Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. [Y] [N] Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. [Y] [N] Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. [Y] [N] Substitution request is fully documented and properly submitted in accordance with "Product Substitution" and "Submittals" Articles in Division 01 Section "Product Requirements."
 - 5. [Y] [N] Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. [Y] [N] Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. [Y] [N] Requested substitution is compatible with other portions of the Work.
 - 8. [Y] [N] Requested substitution has been coordinated with other portions of the Work.
 - 9. [Y] [N] Requested substitution provides specified warranty.
- B. I hereby certify that the above statements are true.
- C. _____
- D. Submitter's signature

1.3 CONTRACTOR'S STATEMENT

- A. I have reviewed this substitution request and am in agreement with the information presented and statements made. This proposal is complete, and there will be no further charges to the Owner as a result of the acceptance of this substitution.
- B. _____
- C. Contractor's signature

PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT

SUBSTITUTION DURING CONSTRUCTION REQUEST FORM
00 6325 - 2
12/21/2022

END OF DOCUMENT 00 6325

SECTION 00 7200 - GENERAL CONDITIONS

1.1 FORM OF GENERAL CONDITIONS

- A. AIA Document B132, General Conditions of the Contract for Construction, 2019 Edition, is the General Conditions between the Owner and Contractor.
- B. Refer to this document for pertinent information. Failure to consult this document shall not relieve the contractor of his obligations therein. Copies of this document may be viewed at the office of the Architect, and may be purchased at the following location:
 - a. AIA Michigan
 - b. 4219 Woodward Avenue
 - c. Detroit, MI 48201
 - d. (313) 965-4100

1.2 SUPPLEMENTARY CONDITIONS

- A. Refer to Document 00 7300 for amendments to these General Conditions.

END OF DOCUMENT 00 7200

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SECTION 00 7300 - SUPPLEMENTARY CONDITIONS

INTENT

- 1.1 These Supplementary Conditions amend and supplement the General Conditions AIA A201 - 2007 defined in Document 00 7200 and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.
- 1.2 The terms used in these Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.
 - A. MODIFICATIONS TO AIA A 201**
 - B. ARTICLE 1 – GENERAL PROVISIONS**
- 1.3 1.1 BASIC DEFINITIONS
- 1.4 Make the following changes to subparagraph 1.1.1:
 - A. 1.1.1 In the first sentence, replace the phrase "Conditions of the Contract" with the phrase "Contracting Requirements."
- 1.5 Add the following paragraph 1.1.9:
 - A. 1.1.9 The Project Manual is a volume assembled for the Work which may include Procurement Requirements, Contracting Requirements, and Specifications.
- 1.6 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS
- 1.7 Add the following clause to Subparagraph 1.2.1
 1. .1 Indicated results shall include those that can be reasonably inferred from the Contract Documents, whether expressly stated or not.
- 1.8 Add the following subparagraph to Paragraph 1.2:
 - A. 1.2.4: In the case of an inconsistency between Drawings and Specifications, or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

B. ARTICLE 3 – CONTRACTOR

1.9 3.4 LABOR AND MATERIALS

1.10 Add the following subparagraphs to Paragraph 3.4:

- A. 3.4.4: After the Contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements of the Specifications (Division 01).
- B. 3.4.5: By making requests for substitutions based on Subparagraph 3.4.4 above, the Contractor:
1. .1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
 2. .2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
 3. .3 certifies that the cost data presented is complete and includes all related costs under this Contract but excludes costs under separate Contracts, and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
 4. .4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
- C. 3.4.6: Not later than 30 days from the Contract Date, the Contractor shall provide a list showing the name of the manufacturer proposed to be used for each of the principle products called for in the Specifications, and where applicable, the name of the installing Subcontractor.
1. .1 The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or the Architect to reply promptly shall constitute notice of no reasonable objection. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed manufacturer must conform to such requirements.
- D. 3.4.7: The Owner's cost for Architect's services, at Architect's normal billing rates, for review of substitution requests shall be deducted from the Contract Amount regardless of Architect's recommendation of acceptance or rejection of the substitution.

1.11 3.6 TAXES

1.12 Add the following subparagraph to Paragraph 3.6:

- A. 3.6.2: The Owner is a nonprofit corporation and therefore is exempt from State Sales and Use Tax and Federal Excise Taxes. However, the Contractor is responsible for the payment of any tax obligation it may incur in connection with the Work of this Project.

1.13 3.12 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. Add the following subparagraph 3.12.11 to Paragraph 3.12:
- B. 3.12.11: The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional resubmittals.

1.14 3.18 INDEMNIFICATION

1.15 Make the following changes in Subparagraph 3.18.1:

- A. 3.18.1: In the first sentence, after the words ". . . or resulting from", insert the words "or in connection with". After the words "damage, loss or expense is", delete the phrase beginning with "attributable to . . ." and ending with ". . . regardless of whether or not such claim, damage, loss or expense is". In the second sentence, after the words ". . . of indemnity", insert the words "or contribution".

1.16 Add the following subparagraphs to Paragraph 3.18:

- A. 3.18.3 "Claims, damages, losses and expenses" as these words are used in this agreement shall be construed to include, but not be limited to (1) injury or damage consequent upon the failure of or use or misuse by the Contractor, his subcontractors, agents, servants or employees, of any hoist, rigging, blocking, scaffolding, or any and all other kinds of items of equipment, whether or not the same be owned, furnished or loaned by the Owner; and (2) all attorney's fees and costs incurred in bringing an action to enforce the provisions of this indemnity or any other indemnity contained in the General Conditions, as modified by the Supplementary Conditions.
- B. 3.18.4: Only to the extent prohibited by law, the obligations of the Contractor under this agreement shall not extend to the liability of the Owner, Architect, their agents or employees, arising out of their negligence.

C. ARTICLE 4 – ARCHITECT

1.17 4.1 GENERAL

1.18 Add the following clause to subparagraph 4.1.1:

- 1. .1: The terms Architect and Architect/Engineer as defined here and used in the Contract Documents shall mean Tower Pinkster Titus Associates, Inc.

1.19 4.2 ADMINISTRATION OF THE CONTRACT

1.20 Add the following clause 4.2.2.1 to subparagraph 4.2.2:

1. .1 The Owner's cost for Architect's services, at Architect's normal billing rates, for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

B. Add the following clause 4.2.7.1 to subparagraph 4.2.7

1. .1 In no case will the Architect's review period on any submittal be less than 14 days after receipt of the submittal from the Contractor.

1.21 Add the following clause 4.2.14.1 to subparagraph 4.2.14:

1. .1 The Owner's cost for Architect's services, at Architect's normal billing rates, in responding to requests of the Contractor shall be deducted from the Contract Amount if the intent of the documents is clear in the opinion of the Architect, or if the request for information contains a request for substitution.

B. ARTICLE 7 – CHANGES IN THE WORK

1.22 7.2 CHANGE ORDERS

1.23 Add the following Subparagraph 7.2.2:

A. 7.2.2: Adjustments to the Contract Sum shall be based on the Contractor's direct cost plus overhead and profit.

B. 7.2.3: Contractor's direct cost shall be determined in accordance with Subparagraph 7.3.6.

1. .1: All proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving more than \$100.00 be approved without such itemization.

C. 7.2.4: Combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

1. .1: For the Contractor, for Work performed by the Contractor's own forces, 15 percent of the cost.
2. .2: For the Contractor, for Work performed by the Contractor's Subcontractor, 5 percent of the amount due to the Subcontractor.
3. .3: For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor or Sub-subcontractor's own forces, 15 percent of the cost.
4. .4: For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractor's, 5 percent of the amount due to the Sub subcontractor.

D. ARTICLE 9 – PAYMENTS AND COMPLETION

1.24 9.3 APPLICATIONS FOR PAYMENT

1.25 Add the following Clauses 9.3.1.3 and 9.3.1.4 to Subparagraph 9.3.1 of 9.3:

1. .3 Until the Work is 50 percent complete, the Owner will pay 90 percent of the amount due the Contractor on account of progress payments. At the time the work is 50 percent complete and thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Architect and in the absence of other good and sufficient reasons, the Architect will (on presentation by the Contractor of Consent of Surety for each application) authorize any remaining partial payments to be paid in full.
2. .4 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Architect (or if the Surety withholds its consent) or for other good and sufficient reasons.

1.26 Add the following Clause 9.3.1.3 to Subparagraph 9.3.1 of 9.3:

1. .3 Until the Work is Substantially Complete, the Owner will pay 90 percent of the amount due the Contractor on account of progress payments.

1.27 Add the following Paragraph 9.11 to Article 9:

1.28 9.11 LIQUIDATED DAMAGES

- A. 9.11.1 The Owner will suffer financial loss if the Project is not substantially complete on the date set forth in the Contract Documents. The Contractor and the Contractor's Surety, if any, shall be liable for and pay to the Owner the sums hereinafter stipulated as liquidated damages for each calendar day of delay until the Work is Substantially Complete: **<Insert amount in words>** Dollars (**\$<insert amount in numbers>**).

B. ARTICLE 11 – INSURANCE AND BONDS

1.29 11.1 CONTRACTOR'S LIABILITY INSURANCE

1.30 Add the following Clauses 11.1.1.9 and 11.1.1.10 to 11.1.1:

1. .9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:
 - a. A. Premises Operations (including X, C, and U coverages as applicable).
 - b. B. Independent Contractor Protective.
 - c. C. Products and Completed Operations.
 - d. D. Personal Injury.

- e. E. Contractual, including specified provision for Contractor's obligation under Par. 3.18.
- f. F. Owned, non-owned and hired motor vehicles.
- g. G. Broad Form Property Damage including Completed Operations.

- 2. .10 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

1.31 Add the following Clause 11.1.2.1 to 11.1.2:

- 1. .1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law:
 - a. A. Commercial General Liability (including Premises-Operations; Independent Contractor's Protective; Products and Completed Operations; Broad Form Property Damage):
 - 1) 1) General Aggregate (Applied in total to this Project only) \$<insert \$\$>.00
 - 2) 2) Bodily Injury:
 - a) a. Each Occurrence \$<insert \$\$>.00
 - 3) 3) Products and Completed Operation to be maintained
 - 4) for one Year after final payment, aggregate \$<insert \$\$>.00
 - 5) 4) Personal Injury \$<insert \$\$>.00
 - 6) 5) Fire Damage (Any one fire) \$<insert \$\$>.00
 - 7) 6) Medical Expense (Any one person) \$<insert \$\$>.00
 - 8) 7) Property Damage Liability Insurance shall provide X, C, and U coverage.
 - 9) 8) Broad Form Property Damage Coverage shall include Completed Operations.
 - b. B. Business Auto Liability on Combined Single Limit or Occurrence Basis d (including owned, non-owned and hired vehicles):
 - 1) 1) Combined Single Limit Basis \$<insert \$\$>.00
 - c. C. Umbrella Excess Liability:
 - 1) 1) Each Occurrence \$<insert \$\$>.00
 - 2) 2) Aggregate \$<insert \$\$>.00
 - d. D. Worker's Compensation:
 - 1) 1) State Statutory
 - 2) 2) Applicable Federal Statutory
 - 3) 3) Employer Liability:
 - a) a. Each Accident \$<insert \$\$>.00
 - b) b. Disease - Policy Limit: \$<insert \$\$>.00
 - c) c. Disease - Each Employee: \$<insert \$\$>.00

1.32 Replace Paragraph 11.2 with the following:

1.33 11.2 OWNER'S LIABILITY INSURANCE

A. 11.2.1 The Contractor shall provide Owner's Liability Insurance naming the Owner, Architect and the Architect's Consultants as additionally insured.

B. 11.2.2 Owner's Liability Insurance shall not be for less than the following limits:

1. .1 Owner's Protective:

a. A. Bodily Injury:

- 1) 1) Each Occurrence \$<insert \$\$>.00
- 2) 2) Aggregate \$<insert \$\$>.00

b. B. Property Damage:

- 1) 1) Each Occurrence \$<insert \$\$>.00
- 2) 2) Aggregate \$<insert \$\$>.00

1.34 11.3 PROPERTY INSURANCE

1.35 Delete Clause 11.3.1.4 and substitute the following:

1. .4 The Contractor shall provide insurance coverage for portions of the Work stored off the site or in transit, after written approval of the Owner, at the value established in the approval when such portions of the Work are included in an Application for Payment under Subparagraph 9.3.2.

1.36 11.4 PERFORMANCE BOND AND PAYMENT BOND

1.37 Add the following Subparagraph 11.4.3:

A. 11.4.3: The bond value requirements are as follows:

1. .1 Provide a 100 percent Performance Bond on AIA A312.
2. .2 Provide a 100 percent Payment Bond on AIA A312.
3. .3 Deliver bonds within 3 days after execution of the Contract.

1.38 Add the following Article 16:

A. ARTICLE 16 – EQUAL OPPORTUNITY

1.39 16.1 CONTRACTOR'S EMPLOYMENT POLICY

A. 16.1.1 The Contractor shall maintain policies of employment as follows:

1. .1 The Contractor and its sub-contractors shall not discriminate against any employee or applicant for employment with respect to hire, tenure, terms, conditions or privileges or employment, or any matter directly or indirectly related to employment, because of race, color, religion, sex, national origin, or age. Breach of this covenant will be regarded as a material breach of the Contract.
2. .2 The Contractor and all Subcontractors shall in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, or age.

END OF DOCUMENT 00 7300

SECTION 01 2200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 01 2600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Supplemental Excavation, Satisfactory Soil Fill:
 - 1. Description: Unit price for the removal of unforeseen unsatisfactory soil and replacement with satisfactory soil, according to Section 31 2000 "Earth Moving."

2. Unit of Measurement: Cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
- B. Unit Price No. 2: Supplemental Excavation, Engineered Fill:
1. Description: Unit price for the removal of unforeseen unsatisfactory soil and replacement with engineered fill, according to Section 31 2000 "Earth Moving."
 2. Unit of Measurement: Cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
- C. Unit Price No. 3: Unforeseen replacement of existing slab on-grade.
1. Description: Unit price for unforeseen removal of existing concrete slab on-grade and replacement with new slab on-grade according to Section 02 4119 "Selective Demolition" and Section 03 3000 "Cast-In-Place Concrete."
 2. Unit of Measurement: 100 square feet.

END OF SECTION 01 2200

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Stadium Turf - Synthetic Turf System.
 - 1. Base Bid: Basis of Design FieldTurf: Vertex.
 - 2. Alternate: If Alternate No. 1 is accepted, Basis of Design shall be FieldTurf: Revolution 360 monofilament system, and all substitutes from approved manufacturers shall me performance spec of the Revolution 360 monofilament turf system.

**PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT**

**ALTERNATES
01 2300 - 2
12/21/2022**

- B. Alternate No. 2: Stadium Turf - Synthetic Turf System.
 - 1. Base Bid: Basis of Design FieldTurf: Vertex.
 - 2. Alternate: If Alternate No. 1 is accepted, Basis of Design shall be FieldTurf: CORE monofilament system, and all substitutes from approved manufacturers shall me performance spec of the CORE monofilament turf system.

END OF SECTION 01 2300

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Document 00 2600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. Section 01 2300 "Alternates" for products selected under an alternate.
 - 3. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - a. Unavailability due to failure to procure products in a timely manner does not constitute substitution for cause, and will be considered as substitution for convenience.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form provided in Project Manual.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect,

- sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 - 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
- 1.4 QUALITY ASSURANCE
- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.
- 1.5 PROCEDURES
- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.
- 1.6 SUBSTITUTIONS
- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 20 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

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SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests (Bulletins): Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Unit-Price Adjustment: See Section 01 2200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

SECTION 01 2900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 2200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 2. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 01 3200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
5. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.

3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Sustainable design action plans, including preliminary project materials cost data.
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire Owner's insurance.

- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. RFIs.
 - 3. Digital project management procedures.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 2. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.
 - 3. Section 01 9113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
 3. Owner's cost for Architect's services, at Architect's normal billing rate, in responding to requests for information from the Contractor, will be deducted from the Contract Amount if the intent of the documents is clear in the opinion of the Architect.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Name of Architect[and Construction Manager].
 3. Architect's Project number.
 4. Date.
 5. Name of Contractor.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within ten days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect and Construction Manager.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 2016.
 4. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement included in this Project Manual.
- B. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Contract Drawings are available in Revit 2022.
 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement, with modifications on Document 00 6324 "BIM Transfer Waiver."
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106, with modifications on Document 00 6324 "BIM Transfer Waiver."
- C. Conditions of Use of Architect's Digital Data Files: As follows:
1. Architect makes no representation as to the compatibility of these files with user's hardware or software beyond the specified release of the referenced specifications.
 2. Data contained on these electronic files are part of Architect's instruments of service and shall not be used by receiving party or anyone else receiving this data through or from receiving party for any purpose other than as a convenience in the support of construction coordination for the referenced project. Any other use or reuse by receiving party or by others will be at receiving party's sole risk and without liability or legal exposure to Tower Pinkster Titus Associates. Receiving party agrees to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against the Architect, its officers, directors, employees, agents or subconsultants that may arise out of or in connection with receiving party's use of the electronic files.
 3. Furthermore, receiving party shall, to the fullest extent permitted by law, indemnify and hold Architect harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from receiving party's use of these electronic files.
 4. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files receiving party receives. In the

event that a conflict arises between the hard-copy construction documents prepared by Architect and the electronic files, the hard-copy construction documents shall govern. Receiving party is responsible for determining if any conflict exists. By receiving party's use of these electronic files, receiving party is not relieved of any duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

5. Because information presented on the electronic files can be modified, unintentionally or otherwise, Architect reserves the right to remove all indicia of ownership and/or involvement from each electronic display.

D. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.

- q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Construction Manager will conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Status of sustainable design documentation.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of Proposal Requests.
 - 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
4. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
5. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
6. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
7. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's and Construction Manager's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - a. Completeness: Submittal packages that do not contain all required submittals, with the exception of verification samples when selection samples are also required, will be returned without the Architect and Construction Manager taking action.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture, and other similar types of variations are expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.

2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation

of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return it.

1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action, as follows:
 - a. Reviewed: No corrections, no marks. Submittal complies with the design intent of the Contract Documents.
 - b. Furnish as Corrected: Minor corrections; all items can be fabricated or furnished without further correction; checking is complete and all corrections are obvious without ambiguity.
 - c. Revise and Resubmit: Minor corrections; noted items must not be furnished or fabricated without further corrections; checking is not complete; details of items noted are to be clarified before resubmitting; items not noted to be corrected can be fabricated or furnished under this stamp.
 - d. Rejected: Submittal is not in compliance with the design intent of the Contract Documents. Provide new submittal that complies with Contract Documents. Any delay resulting from the submission of items not complying with the Contract Documents is solely the responsibility of the Contractor, which will bear all associated costs.

- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

- E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.

- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.

3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
 - E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
 - F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory has the same meaning as testing agency.
 - I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
 - J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.
- 1.3 DELEGATED-DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- 1.4 CONFLICTING REQUIREMENTS
- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
 - B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience, include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Statement on condition of substrates and their acceptability for installation of product.
 2. Statement that products at Project site comply with requirements.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.
 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 3. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and will engage for the activities indicated.
1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with

additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect , through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
 - 3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's and Construction Manager's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 8. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - b. Testing will not be performed by the installer, or a subcontractor to the installer.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.

- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as appropriate, as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.
- B. Engage testing and inspection services except where indicated as by Owner in other Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and Construction Manager's reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 4200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).

5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. MDOT; Michigan Department of Transportation; www.michigan.gov/mdot.
 7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 8. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

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SECTION 01 5639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 31 1000 "Site Clearing" for removing existing trees and shrubs.
 - 3. Section 32 9300 "Plants" for replacing damaged trees within protection zones.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches (2400 mm) unless otherwise indicated.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.
 - c. Quality-control program.
 - d. Coordination of Work and equipment movement with the locations of protection zones.
 - e. Trenching by hand or with air spade within protection zones.
 - f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 2. Detail fabrication and assembly of protection-zone fencing and signage.
 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
 1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 2. Protection-Zone Fencing: None required.
 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 1. Species and size of tree.
 2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

A. Arborist Qualifications: Must have at least three of the following

1. Certified Arborist as certified by ISA.
2. Certified Arborist-Municipal Specialist as certified by ISA.
3. Licensed arborist in jurisdiction where Project is located.
4. Current member of ASCA Registered Consulting Arborist as designated by ASCA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Tree Protection Warranty:

1. Conditions. If, within a period of two years after date of substantial completion, any tree or trees in protection areas die or suffer significant loss due to damage caused by improper tree protection to the protection zone, or the tree itself, then the Contractor shall pay for all costs associated with fully removing and replacing the tree.

- a. Removal will include (but not be limited to) trimming, cutting, hauling away, stump grinding, excavation, backfill, replacement, staking, guying, and inclusion of full new tree warranty according to Section 32 9300 "Plants".
2. Replacements:
 - a. See FIELD QUALITY AND CONTROL section near the end of this specification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
 2. Planting Soil: Planting soil as specified in Section 32 9300 "Plants".
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 1. Type: Shredded hardwood.
 2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
 1. Wood Protection-Zone Fencing: Constructed of two 2-by-4-inch (50-by-100-mm) horizontal rails, with 4-by-4-inch (100-by-100-mm) preservative-treated wood posts spaced not more than 96 inches (2400 mm) apart, and lower rail set halfway between top rail and ground.
 - a. Height: 48 inches (1200 mm).
 - b. Lumber: Comply with requirements in Section 06 1000 "Rough Carpentry." Previously used materials may be used when approved by Architect.
 2. Gates: Single- or Double- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm).
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 1. Size and Text: As shown on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 2-inch (50-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 2. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet (10.5 m) on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 2. Cut Ends: Do not paint cut root ends.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 31 2000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
 - 1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning, raising, reducing, and thinning where indicated.
 - b. Specialty Pruning: Structural restoration vista and utility where indicated.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and spread over areas identified by Architect or stockpile in areas approved by Architect, unless the branches are diseased or otherwise could cause deleterious effects to any impacted portion of the project as identified by Arborist.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide one new tree of 4-inch to 6-inch caliper size for each tree that measures 12 inches (300 mm) or smaller in caliper size.
 - 2. Large Trees: Provide one new tree of 8-inch to 10-inch caliper size for each tree being replaced that measures more than 12 inches (300 mm) in caliper size.
 - a. Species: As selected by Architect.
 - 3. Plant and maintain new trees as specified in Section 32 9300 "Plants."

- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch (50-mm) uniform thickness to remain.

- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 5639

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 2300 "Alternates" for products selected under an alternate.
 - 2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 01 4200 "References" for applicable industry standards for products specified.
 - 4. Section 01 7700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."
- F. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 - 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.

4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

1.5 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. **Manufacturer's Warranty:** Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.
1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
 2. **Specified Form:** When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
 7. All products shall be free from asbestos.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- ## 2.2 COMPARABLE PRODUCTS
- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.

5. Samples, if requested.

- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."
 1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.

- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for coordination of , and limits on use of Project site.
 - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 02 4119 "Selective Demolition" for demolition and removal of selected portions of the building.
 - 5. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.

- B. Certificates: Submit certificate signed by land surveyor, certifying that location and elevation of improvements comply with requirements.

- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 5. Entity performing cutting and patching shall be experienced and skilled in working with the material being cut and patched.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect through Construction Manager in accordance with requirements in Section 01 3100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - a. Include footings, foundations, anchor bolts, and similar items.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 1000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.
- 3.7 STARTING AND ADJUSTING
- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
 - B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
 - C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 01 7839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 7. Submit certification that no asbestos-containing materials were incorporated into the Work.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
 - 6. Advise Owner of changeover in utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements.
 - 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 2900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Specific warranties as specified in individual Specification Sections.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.7 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Submit list of incomplete items in the following format:
 - a. PDF Electronic File: Architect, through Construction Manager, will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit on digital media acceptable to Architect.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.

- j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste-disposal requirements in Construction Manager's Project Manual

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 7300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

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SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Systems and equipment operation manuals.
 - 3. Systems and equipment maintenance manuals.
 - 4. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

- D. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - 2. Performance and design criteria if Contractor has delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 - 1. Product name and model number. Use designations for products indicated on Contract Documents.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routine and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.

6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.
- 1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS
- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.

- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for final property survey.
 - 2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.

- d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or [**Construction**] [**Work**] Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3100 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:

- a. Project name.
- b. Date.
- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Architect and Construction Manager.
- e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

1.5 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file.
 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.6 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from

**PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT**

**PROJECT RECORD DOCUMENTS
01 7839 - 4
12/21/2022**

deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For instructor and videographer.

1.3 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. At completion of training, submit complete training manual(s) for Owner's use prepared in same format required for operation and maintenance manuals specified in Section 01 7823 "Operation and Maintenance Data."

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "Project Management and Coordination."

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.

- c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner , through Construction Manager, with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, written, or demonstration performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on CD-ROM or thumb drive.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.

3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
- E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7900

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SECTION 02 4119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 01 7300 "Execution" for cutting and patching procedures.
2. Section 31 1000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.

- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.
- D. Predemolition photographs or video.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. **<Insert items to be removed by Owner>**.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video, and templates as appropriate.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- E. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
 - 4. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Maintain fire watch during flame-cutting operations.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 5323 for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.7 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 4119

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.

1.3 INFORMATIONAL SUBMITTALS

- A. Material test reports.
- B. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301 (ACI 301M).
 2. ACI 117 (ACI 117M).

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.3 CONCRETE MATERIALS

- A. Cementitious Materials:
1. Portland Cement: ASTM C 150/C 150M, Type I or Type I/II, gray.
 2. Fly Ash: ASTM C 618, Class F or C.
 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33/C 33M, graded.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - 3.
 4. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50(0.3 mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50(0.3 mm).
- C. Air-Entraining Admixture: ASTM C 260/C 260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

- E. Water: ASTM C 94/C 94M and potable.
- F. Porosity-Reducing Admixture: Proprietary formulation that reduces concrete porosity by closing capillaries in the concrete as it cures.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Concrete Moisture Solutions, Inc.; Barrier One.
 - b. Specialty Products Group; Vapor Lock 20/20.

2.4 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum water-vapor permeance of 0.02 U.S. perms, minimum 15 mils(0.38 mm) thick monolithic polyolefin sheet. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.
 - b. Insulation Solutions, Inc.; Viper VaporCheck II 15-mil.
 - c. Poly-America, L.P.; Husky Yellow Guard Vapor Barrier 15 Mil ASTM E-1745 Class A.
 - d. Reef Industries, Inc; Griffolyn 15 mil Green.
 - e. Stego Industries, LLC; Stego Wrap 15 mil Class A.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Anti-Hydro International, Inc; A-H Curing Compound #2 DR WB.
 - 2. ChemMasters, Inc; Safe-Cure Clear DR.
 - 3. Dayton Superior; Clear Resin Cure J11W.
 - 4. Euclid Chemical Company (The); an RPM company; Kurez DR VOX.
 - a. Kaufman Products, Inc; Thinfilm 420.
 - 5. L&M Construction Chemicals, Inc; L&M CURE R.
 - a. Lambert Corporation; AQUA KURE - CLEAR.
 - b. Nox-Crete Products Group; Resin Cure E.

- c. Right Pointe; Clear Water Resin.
- d. SpecChem; PaveCure Rez.
- e. TK Products; TK-2519 DC WB.
- f. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.
- g. W.R. Meadows, Inc; 1100-CLEAR SERIES.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.8 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. 20 percent fly ash or 30 percent ground blast furnace slag.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
 - 4. Slump Limit: 5 inches (125 mm), plus or minus 1 inch (25 mm).
 - 5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- B. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.2 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.5 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view,.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless

manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.

- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no

compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).

11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests:
 - a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 48 hours of completion of floor finishing and promptly report test results to Architect.

END OF SECTION 03 3000

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and nailers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Grounds.
- B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 3 grade; SPIB.

2. Eastern softwoods; No. 3 Common grade; NeLMA.
3. Northern species; No. 3 Common grade; NLGA.
4. Western woods; Standard or No. 3 Common grade; WCLIB or WWPA.

- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. All nailers to be Wood-Preservative Treated.

2.4 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC58 as appropriate for the substrate.
1. Material for Exterior Applications: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- D. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1000

SECTION 11 6800 - PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes athletic playfield equipment as follows:

- 1. Football Goal Posts
- 2. Soccer Goals

- B. Related Sections:

- 1. Section 03 3000 Cast in Place Concrete
- 2. Section 31 2010 Earthwork

1.3 SCOPE

- A. The work under this section of the specifications shall consist of furnishing all labor, materials and equipment necessary to install new football goal posts and soccer goals.

1.4 QUALITY ASSURANCE

- A. Warranty Guarantee: The Contractor and any Sub-Contractors hereunder guarantee their respective work against defective materials or workmanship for a period of two (2) years from the date of filing notice of completion and an acceptance by the Owner.
- B. Product Testing: All material installed under this specification shall be subject to testing by Owner at his expense. Any material so inspected and found to be not in strict conformance with this specification shall be promptly removed and replaced by the Contractor at his expense.
- C. General: Comply with NCAA and NFHS specifications.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of equipment.
- C. Samples for Initial Selection: For each type of exposed finish.

1. Manufacturer's color charts.
2. Include Samples of accessories involving color selection.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For equipment and finishes to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 FOOTBALL EQUIPMENT

1. Football Goal PostsFootball goal posts shall: Be formed with an aluminum pipe capable of supporting the horizontal cross bar 8'-0" in front of the vertical upright.
 2. Upright shall extend or be supported in a concrete footing approximately 5' in diameter and secured with an anchor pin or anchor bolts.
 3. Cross bar shall be an aluminum structural tube 10'-0" above field level.
 4. Uprights shall be 4" O.D. aluminum structural tube extending 20'-0" above horizontal cross bar. Uprights and cross bar shall be capped with zinc plated formed metal caps. Upright metal caps shall incorporate nylon wind directional flags.
 5. Wind directional flag shall be red.
 6. Goal post shall be powder-coated white.
- B. Goal posts shall be from one of the following manufacturers:
1. AAE - No. ASG-HS/8, (800) 523-5471
 2. Sportsfield Specialties - No. GP820HS, (888) 975-3343
 3. UCS - No. 751-6120, (800) 526-4856
 4. SportsEdge – No. SEF305P, (800) 334-6057
- C. Goal post pads shall be "professional" style made from 6" thick cylindrical shaped high density polyurethane foam, 6'-0" in length. Foam cylinder shall have a rear cut-out and be completely covered in a 16 oz. polyester reinforced vinyl cover concealed velcro closure flaps for ease of installation and removal. Color to be selected by Owner from manufacturers standard colors.
1. Letters and logos shall be stenciled onto the vinyl goalpost pad with a maximum of ten (10) letters per pad. Refer to plans for lettering and logo details and colors.
 2. The Contractor shall supply a color sample or swatch to the Owner for color selection for the pads and lettering.
 3. Custom logos and/or font styles can be provided to supplier in vector format if required.
- D. Goal post pads shall be from one of the following manufacturers:
1. AAE - No. GP6R

2. Sportsfield Specialties - No. GPPR
3. UCS - No. 260-67
4. SportsEdge – No. SEF302L

E. E. Pre-manufactured goalpost access box shall be from one of the following manufacturers:

1. Sportsfield Specialties – No. GPAFIT
2. SportsEdge – No. SEF304
3. AAE – No. FBC-GA

2.2 SOCCER GOALS

A. A. Full size round soccer goals complete with nets, wheel kits and safety anchoring system, shall be from one of the following manufacturers:

1. Aluminum Athletic Equipment Co. (AAE) 800-523-5471
2. Sportsfield Specialties 888-975-3343
3. SportsEdge 800-334-6057
4. United Canvas Swing (UCS) 800-526-4856

B. Components:

1. Frame: 8'H x 24'W x 4'B x 10'D.
 - a. 4" Round aluminum tubing.
 - b. White powder coat finish.
2. Ground Bar: Aluminum
3. For Infill Turf Fields: Include safety anchor system to attach to football goal gooseneck.
4. Nets: 4mm braided polypropylene, 5.5" square mesh.
- 5.

Manufacturer	Product	Model No.	Type
1. AAE	Goal	SGR-P/I	Round
	Net	Included	Color TBD
	Wheels	Included	
	Safety Anchor	SGAB-GP	
2. SportsEdge	Goal	SE700R	Round
	Net	SE755	Color TBD
	Wheels	SE751	
	Safety Anchor	SEF390	
3. Sportsfield Specialties	Goal	SG4950	Round
	Net	Standard	Color TBD
	Wheels	SG4955	
	Safety Anchor	SG2SGP	
4. UCS	Goal	900-8024	Round
	Net	Included	Color TBD

Wheels Included
Safety Anchor 751-1000

6. Contractor shall provide a minimum two sets of four(4) sand bag weights by the selected manufacturer for temporary anchoring. Sand bags are to be provided in addition to the manufacturer's safety anchoring system.

2.3 CONCRETE

- A. Concrete shall conform to Section 03 3000 Cast In Place Concrete

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not install goals until site grading is complete
- B. Examine substrates, areas, and conditions for compliance with requirements for earthwork, subgrade elevations, surface and subgrade drainage, and other conditions affecting performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Posts shall be set to the lines shown on the drawings, with holes drilled such that posts will be centered in the concrete bases.
- B. Holes shall be filled with concrete to 6" below grade. See detail sheet as per installation of the remaining 6" to grade.
- C. Concrete shall cure a minimum of 72 hours prior to installation of goal post.
- D. All posts shall be set plumb.
- E. Refer to Manufacturer's installation cut sheets for exact location of sleeve or bolt template
- F. Comply with manufacturer's written installation instructions for each equipment type unless more stringent requirements are indicated. Anchor equipment securely, positioned at locations and elevations indicated.
- G. Post Set with Concrete Footing: Comply with Section 03 3000 "Cast-in-Place Concrete" for measuring, batching, mixing, transporting, forming, and placing concrete.

1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
2. Embedded Items: Follow equipment manufacturer's written instructions and drawings to ensure correct installation of anchorages for equipment.

3.3 CLEAN UP AND DISPOSAL

- A. Remove from the site all equipment, materials, and debris resulting from construction work including this section. Leave work area neat and clean and in a condition acceptable by the Landscape Architect and Owner. All work shall be complete, ready for use, at the time of final acceptance.

END OF SECTION 11 6800

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SECTION 26 0500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical Scope of work
 - 2. Electrical equipment coordination and installation.
 - 3. Rough-in
 - 4. Electrical Demolition
 - 5. Common electrical installation requirements.

1.3 SCOPE OF WORK

- A. The scope of work is to include but not be limited to the following:
 - 1. Obtain all required electrical construction permits and inspections.
 - 2. Provide complete electrical installation including all components, i.e. light fixtures, lamps, receptacles, conduit, wire, etc.
 - 3. Provide raceway system for owner provided play clocks..
 - 4. Provide selective demolition of electrical systems and equipment as indicated on the drawings.
 - 5. Submit documentation such as shop drawings, record documents, maintenance manuals, infrared scan results, systems test results, fire alarm system certification, etc. as specified.

1.4 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate electrical systems, equipment and materials installation with other building components.

- C. Coordinate installation of electrical panelboard tubs, backboxes and concealed conduit and tubing with masonry/concrete work.
- D. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
- E. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- G. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

1.5 INTERPRETATIONS

- A. It is the intent of these Drawings and Specifications to result in a complete electrical installation in complete accordance with applicable code and ordinances.
- B. Drawings are diagrammatic in character and do not necessarily indicate every required junction box, pull box, ell, etc. Items not specifically mentioned in the specification or noted on the Drawings, but which are necessary to make a complete working installation, shall be included.
- C. Drawings and Specifications are complementary. Whatever is called for in either is binding as though called for in both. The more stringent requirement shall govern.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION

- A. Disconnect, demolish, and remove electrical system equipment and components indicated to be removed.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Inaccessible Work: Cut and remove buried raceway and wiring, indicated to be demolished, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. All existing fixtures, equipment, etc., that are removed and not indicated to be relocated, or reused, shall first be offered to the Owner, after Owner has approved, the remaining removed items shall become property of the Contractor and shall be removed from the building site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

- F. Protect existing electrical equipment and installations not indicated to be removed. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- G. Contractor shall examine the Drawings and Specifications, and existing conditions. All costs relating to maintaining existing services or relocating existing circuits and/or equipment shall be included in the bid. Contractor is required to complete all work necessary to meet these requirements without additional expense to the Owner or his Representative.
- H. Equipment Replacement: Contractor shall verify all circuit breakers and fuse sizes against the existing wire size prior to replacing switchboards, panelboards and disconnect switches. Notify the Architect of any discrepancies prior replacing equipment.

3.2 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 49 for rough-in requirements.

3.3 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- B. Arrange for chases, slots and openings in other building components during progress of construction, to allow for electrical installations.
- C. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- D. Install systems, materials and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- E. Measure indicated mounting heights to bottom of unit for suspended items and to bottom of unit for wall-mounting items or as indicated on drawings.
- F. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- H. Right of Way: Give to piping systems installed at a required slope.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 0500

SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.3 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, hand holes and attachment details.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

1.5 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. EMT: Comply with ANSI C80.3 and UL 797.
- D. FMC: Comply with UL 1; zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- F. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- G. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC and EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

- F. Fittings for LFNC: Comply with UL 514B.
- G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 PVC COATED RIGID METAL CONDUIT

- A. The PVC coated rigid metal conduit shall be hot dip galvanized inside and out. The interior galvanizing shall be listed per UL 6. The exterior galvanizing shall be listed per UL 6 as primary corrosion protection. Thread protectors shall be used on the exposed threads of the PVC coated conduit. PVC coated RMC steel conduit shall comply with UL 6, ANSI C80.1, and NEMA RN-1 standards without exception.
- B. The PVC coating, in compliance with NEMA RN-1, shall be nominal 40 mils in thickness continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles or pin- holes. PVC shall be UL listed as a primary corrosion protection.
- C. A urethane coating shall be uniformly and consistently applied to the interior of conduit. This internal coating shall be a nominal 2 mils thickness. All male threads on elbows and nipples shall be zinc coated using zinc rich paint.
- D. Coated couplings shall be used with coated conduit. The thickness of the coating on couplings shall be at least equal to the thickness of the coating on the conduit. Each coated coupling shall have a flexible PVC sleeve which extends from each end of the coupling and which will overlap the PVC coating on the conduit when the coupling has been installed on the conduit. The length of the sleeve extension(s) shall be at least equivalent to the nominal Trade Size for sizes 1/2" up through 1-1/2". For Trade Size 2" through 6", the length of the sleeve extension(s) shall be at least 2 inches. The PVC sleeve shall be a nominal thickness of 40 mils in thickness. The inside diameter of the overlapping sleeve shall be less than the outside diameter of the PVC-coated conduit.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R as required.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: Hinged type, Screw-cover type, Flanged-and-gasketed type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating and ivory finish coat.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation / A Member of the ABB Group.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- C. Surface Metal Raceways: Satin anodized extruded aluminum with snap-on covers.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Post Glover
 - b. Thomas & Betts Corporation / A Member of the ABB Group
 - c. Wiremold Company
- D. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture ivory color.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hellermann Tyton
 - b. Hubbell, Inc.; Wiring Device Division.
 - c. Lamson & Sessions; Carlon Electrical Products.
 - d. Mono-systems, Inc.
 - e. Panduit Corp.
 - f. Walker Systems, Inc.; Wiremold Company (The).
 - g. Wiremold Company (The); Electrical Sales Division.
- E. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways. Provide concealed support clips or fasten raceway internally. Do not use external mounting straps.

2.7 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard gray paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

2.8 CABLE PATHWAY AND FIRESTOP DEVICE

- A. Manufacturer:
1. Specified Technologies, Inc., EZ-Path fire rated pathway.
 2. Wiremold, FlameStopper FS Series thru-wall fitting for fire walls.
- B. Description: Through-the-wall 3" x 3" steel wiring channel or 4" EMT equipped with heat expanding intumescent fire stopping material.
- C. Wiring channel shall be provided with steel wall plates allowing for single or multiple channels to be ganged together.
- D. Wiring channel shall have an F rating equal to the rating of the barrier in which it is installed.
- E. Wiring channel shall be capable of allowing a 0 to 100 percent visual fill of cable.
- F. Wiring channel shall be tested in accordance with ASTM E 814 (ANSI/UL1479). Channel shall bear the UL classification marking.
- G. Provide the quantity of devices needed to allow a cable pass cross section capacity of 50 percent of the adjacent cable tray cross section.

2.9 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Standard: Comply with SCTE 77.
 2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, "ELECTRIC".
 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Wall Style: Flared wall assembly.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel. (No RNC Allowed)
2. Concealed, Aboveground: Rigid steel.
3. Underground: RNC Schedule 80.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures: NEMA 250, Type 3R or 4.

B. Indoors:

1. Exposed in Unfinished Utility Spaces (mechanical rooms, electrical rooms and tunnels): EMT.
2. Exposed in Finished Spaces: All conduit shall be concealed unless specifically indicated on plans.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit.
4. Concrete Floors: RNC.
5. Concealed in Ceilings and Interior Walls and Partitions: EMT
6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
7. Damp or Wet Locations: Rigid steel conduit.
8. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.

C. Minimum Raceway Size: 3/4-inch trade size(21mm).

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this Article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Provide separate raceways for lighting, receptacle, and motor loads. Do not mix branch circuit wiring for these different loads in the same raceway.
- C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Support raceways as specified in Division 26 Section "Common Work Results for Electrical."

- G. Install temporary closures to prevent foreign matter from entering raceways.
- H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- K. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
 - 2. Conduit and EMT may be surface mounted in Mechanical and Electrical Rooms except for wiring devices, light switches, low voltage devices or any other device shall be concealed in new wall.
 - 3. Surface mounted conduit or EMT may be used where specifically approved by Architect/Engineer. In such situations, the conduit, fastening devices, and junction boxes shall be painted to match the adjacent surface.
- L. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (27mm) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Change from nonmetallic tubing to rigid steel conduit before rising above floor or grade.
- M. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- O. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- P. Tighten set screws of threadless fittings with suitable tools.
- Q. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
 3. Telephone, data and fiber optic cable conduits shall be provided with bushings on conduit ends.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- S. Color-Coding: Paint fire alarm system junction boxes and covers red.
- T. Raceways for Optical Fiber and Communications Cable: Install as follows:
1. 3/4-Inch(19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet(15 m).
 2. 1-Inch(25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet(23 m).
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- U. Telephone, data, AV, security, access control, fiber optic cable system, building control cabling, lighting control, 0-10V dimming control and any other low voltage systems cabling shall be installed in conduit in areas of exposed ceiling. In areas with accessible ceilings, the low voltage systems cables shall be neatly routed and independently supported with cable rings to the nearest cable tray, technology closet, conduit run or equipment connection. Systems to be in conduit in accessible ceiling spaces where required elsewhere in the specification or drawings.
- V. Telephone, data and fiber optic cable system conduit shall be provided with wide sweep bends.
- W. Telephone, data and fiber optic cable outlets shall be provided with a 1 inch conduit stubbed into accessible ceiling space unless noted otherwise on the drawings. Provide bushings on the ends of the conduit.
- X. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- Y. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.00078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Z. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- AA. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- BB. Flexible Connections to Lighting Fixtures:
1. Above ceilings that are continuous to wall: Provide flexible conduit to all recessed lighting fixtures, maximum length as indicated. For fixtures mounted on grid ceilings, provide adequate length of flexible conduit to allow relocation of fixture on grid space in any lateral direction.
 2. Above clouds or above suspended ceiling elements that are visible and exposed, Flexible Connections to Lighting Fixtures shall be limited to reduce sight of flexible conduit. Flexible connections to light fixtures shall not be visible from standing on the floor or nearby landings or overlooks. Minimize angle of visibility, run EMT as necessary and coordinate with trades to group systems to minimize drops. All drops to element/cloud to be EMT and shall not be flex.
- CC. Equipment Grounding Conductor: Install a green equipment grounding conductor in all flexible conduit and non-metallic (PVC) conduit.
- DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- EE. Recessed back-to-back boxes are not permitted in the same wall. Arrange boxes with at least 12 inches of horizontal spacing.
- FF. Recessed Boxes in Masonry Walls: Saw-cut opening for box in masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

- GG. Locate boxes so that cover or plate will not span different building finishes.
- HH. Set floor boxes level and flush with finished floor surface.
- II. Set floor boxes level. Trim after installation to fit flush with finished floor surface.
- JJ. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- KK. Provide stainless steel cover plates on all abandoned boxes that remain from selective demolition.
- LL. Cable pathway and firestop device: Install in locations where indicated on the plans. Arrange singly or in gangs and mounted above accessible ceilings. Install the devices in strict accordance with the manufacturer's recommendations.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches(150 mm) in nominal diameter.
 - 2. Install backfill as specified in Division 31 Section "Earth Moving."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches(300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
 - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout length elbow.
 - 5. Transition from PVC-Schedule 80 (RNC) to RMC underground, no RNC conduit shall exposed outdoors or inside building.
 - 6. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches(75 mm) of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches(1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
 - 7. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Install handholes with bottom below frost line 42" below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 0533

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SECTION 26 0543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried duct banks.
 - 2. Handholes and boxes.

1.2 ACTION SUBMITTALS

- A. Product Data: For accessories for manholes, handholes, and boxes.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design and manhole frame support rings.
 - 4. Ladder details.
 - 5. Grounding details.
 - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.
 - 9. Thomas & Betts; Carlon Electrical Products.
 - 10. Manhattan/CDT; a division of Cable Design Technologies.
 - 11. Spiraduct/AFC Cable Systems, Inc.
- C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- D. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
 - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 5. Cover Legend: Molded lettering, as indicated for each service.
 6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 7. Handholes **12 inches wide by 24 inches long** and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 - e. Quazite
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- H. Direct-Buried Duct Banks:
 - 1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 - 2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
 - 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.
 - 4. Install backfill as specified in Division 31 Section "Earth Moving."
 - 5. Concrete Cap: Install 4" concrete cap at a depth of 30 inches below grade. Cap to extend 6" past each side of overall duct bank width.
 - 6. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill

over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

7. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
8. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
9. Set elevation of bottom of duct bank below the frost line.
10. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
11. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
12. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.3 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.4 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 0543

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants, and, grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants, and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting and capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
2. Division 32 Section "Turf and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

1.2 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within fenced area.
 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 4. Use only hand methods for grubbing within tree protection zone.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
 - 1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 1000

SECTION 31 2000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete slabs-on-grade, walks, and pavement.
5. Subbase and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

B. Related Sections include the following:

1. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Division 33 Section "Subdrainage" for drainage of foundations, slabs-on-grade, walls, and landscaped areas.
3. Division 33 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.
4. Division 33 Section "Plants" for planting bed establishment and tree and shrub pit excavation and planting.
5. Division 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a concrete slab-on-grade, cement concrete pavement, or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 1.5 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 4. Tear Strength: 56 lbf; ASTM D 4533.
 5. Puncture Strength: 56 lbf; ASTM D 4833.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system, specified in Division 31 Section "Dewatering," to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Excavation for Structures: Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- C. Excavation for Walks and Pavements: Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- D. Excavation for Utility Trenches: Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - a. Clearance: 12 inches each side of pipe or conduit.
3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.5 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

- A. General: Place backfill on subgrades free of mud, frost, snow, or ice. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Utility Trench Backfill: Place backfill on subgrades free of mud, frost, snow, or ice.
1. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
 2. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
 3. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
 4. Place and compact initial backfill of subbase material free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
 - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
 5. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
 6. Place and compact final backfill of satisfactory soil to final subgrade elevation.
 7. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- C. Soil Fill: Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use satisfactory soil material.
 2. Under walks and pavements, use satisfactory soil material.
 3. Under steps and ramps, use engineered fill.
 4. Under building slabs, use engineered fill.
 5. Under footings and foundations, use engineered fill.

3.9 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.10 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 and ASTM D 1557:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - a. Under slabs on grade, place 6 inches compacted depth of sand
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.11 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch .
 - 3. Pavements: Plus or minus 1/2 inch .
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.12 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

3.13 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698

3.14 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade and at footing drains as follows:
 - 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft.(186 sq. m) or less of paved area or building slab, but in no case fewer than 3 tests.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet(30 m) or less of wall length, but no fewer than 2 tests.
 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet(46 m) or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- D. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 2000

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SECTION 31 2319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1.3 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, discharge lines, piezometers, and flow-measuring devices; and means of discharge, control of sediment, and disposal of water.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide temporary grading to facilitate dewatering and control of surface water.
- B. Monitor dewatering systems continuously.
- C. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 01 Section "Temporary Facilities and Controls", Division 31 Section "Site Clearing" during dewatering operations.
- D. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- E. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- F. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- G. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- H. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

END OF SECTION 31 2319

SECTION 32 1124 - AGGREGATE BASE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 31 2010 Earthwork – Athletics

1.2 SCOPE

- A. The work under this section of the specification shall consist of furnishing all labor, materials and equipment to produce, place, spread, compact and finish to proper grade and cross section all aggregate base courses according to the drawings and specifications.

1.3 SUBMITTALS

- A. Submit to the Landscape Architect a sieve analysis of the proposed stone to be installed. Sieve analysis shall be dated within 14 days of submission.

1.4 QUALITY ASSURANCE

- 1. Contractor shall have previously installed twelve (12) artificial infill turf bases for turf fields larger than 80,000 square feet in the last three (3) years.
 - a. The contractor is responsible for subgrade fine grading, installation of geotextile fabric, installation of field drainage system, installation of the perimeter nailing system, installation of field water distribution system, and installation of the dynamic stone base.
- 2. Firms must have been in business under the same ownership for at least five (5) years, and shall have been installing similar sports fields for that entire period.
- 3. Contractor shall provide a sieve analysis prior to placement for every 150 ton of stone delivered to site.
- 4. The synthetic turf manufacturer/installer shall perform an inspection of the field base onto which the synthetic turf system is to be installed to examine the finished surface for required compaction, permeability and grade tolerances. Earthwork contractor is responsible for correcting deficient items noted by the turf manufacturer/installer prior to acceptance. The turf installer will accept the aggregate stone base in writing when the Owner's representative provides test results for compaction, permeability and planarity that are in compliance with the project plans and specifications. After any discrepancies between the required materials, application and tolerance requirements noted have been corrected, the synthetic turf installer should submit a written certification of acceptance of the base for installation of synthetic turf system.

1.5 ACCEPTABILITY OF THE WORK

A. Grade: Grade conformance tests shall be conducted on the entire surface. The surface shall have positive drainage of 0.50% inclination.

B.

Planarity: After completion of the compacting operations, the compacted aggregate base shall be tested with a 10' straightedge. Measurements shall be made perpendicular to and across the field at a distance not to exceed 25' feet. The grade will not vary by 1/8" from proposed grades, elevations and slopes provided.

C. The grade of the aggregate base shall be evaluated with a "string test". The contractor shall identify, with paint, every 5 yd line, in-bound lines, side line, touch line and end lines.

D. Aggregate shall be tested as per ASTM F1551-09 at a minimum of 8 locations after final grade as been achieved and accepted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate base material shall conform to specifications for 100% crushed 100% limestone and shall be placed and compacted to the minimum depth shown on plans. Crushed concrete, slag, etc. shall not be allowed. DOT standard classifications do not conform. Modifications of standard DOT aggregate classification maybe required to meet specification. On-site mixing will not be an acceptable method for providing this material.

B. Aggregate Sieve Analysis	Base Material	Percent Passing (Finishing Stone Not to exceed 1" Compacted depth)
1 1/2"	90-100	
1"	75-100	
3/4"	65-95	100
3/8"	40-75	85-100
1/4"	25-65	75-100
No. 4	15-60	60-90
No. 8	0-40	35-75
No. 16	0-20	10-55
No. 30	0-7	0-40
No. 60	0-5	0-15
No. 100	0-3	0-8
No. 200	0-2.0	0-2.0
LBW	Maximum 2.5	Maximum 2

- C. The hydraulic conductivity of the aggregate shall be such that is capable of draining the entire synthetic surface system acting as the main water displacement conductor. The aggregate shall maintain its finished grade elevations. Migration of fines and subsequent loss of finished tolerances will not be accepted.
- D. Material shall be tested by a testing agency selected by the Owner to ensure compliance with the submitted documentation (ASTM D422 particle size analysis and ASTM F1551-09/DIN 18-035:6, permeability to water). A minimum of 8 tests shall be performed at random locations selected by Owner's representative.

PART 3 - EXECUTION

3.1 SUB-GRADE CONSTRUCTION

- A. The sub-grade shall be so constructed as to have uniform stability for a width at least equal to that of the proposed improvements plus of the proposed anchoring system. It shall be brought to an elevation and cross section such that, after being rolled, the surface will be at the required elevation. At the time the sub-grade is prepared, the fill area shall have been constructed to the full width and to at least the elevation of the finished sub-grade.
- B. The material present in the next six (6) inches below the elevation of the sub-grade shall be scarified, mixed and recompact, or otherwise treated to produce a uniform condition. Stones over four (4) inches in size shall be removed from the loosened portion of the sub-grade and disposed as directed by the project representative.
- C. Depressions that develop during the following shall be filled with suitable material, and the rolling shall continue until the sub-grade is uniformly firm, properly shaped and substantially true to grade and cross section. It shall be so maintained until the pavement is place.
- D. Material, other than sand, which will not compact readily under roller shall be removed and replaced with material which will compact readily and that portion of the sub-grade shall be rolled again. Surface
- E. The rolling of the sub-grade shall extend for at least twelve (12) inches outside of each edge of the proposed turf boundaries when possible. Piles or ridges of earth or material that would seriously interfere with the operations of finishing the pavement shall not be left on the shoulders.
- F. During the process of construction sub-grade, the soil shall be maintained in a condition sufficiently moist to facilitate compaction and produce a firm, compact surface.
- G. If, in the preparation of the sub-grade, it becomes necessary to excavate below the elevation of the earth shoulders, ditches or drains shall be provided at frequent intervals to permit ready drainage of surface water from sub-grade to side ditches.
- H. If ruts or other objectionable irregularities form in the sub-grade during construction, the Contractor shall reshape and re-roll the sub-grade before the drainage course is laid. The material used for filling ruts or other depressions shall be of such character as to make it equally desirable for sub-grade purposes as the material presented in the sub-grade.
- I. When the sub-grade is being prepared for placement as an aggregate base course, the elevation of the most finished surface, at the time the next layer is placed, shall not vary by more than 0.02 foot above or below the prescribed elevation at any point where measurement is made.

3.2 AGGREGATE DRAINAGE COURSE

- A. Base course construction shall proceed as follows only after the qualified testing firm has approved the sub-grade construction and the gravel tests.
- B. The base shall be constructed in layers of not more than three (3) inches (75mm) compacted thickness when conventional rolling equipment is used.
- C. If vibratory or other approved special equipment is used, the thickness of every compacted layer may be increased to a maximum of eight (8) inches (200mm).
- D. The finished surface of any aggregate drainage layer shall not vary more than 1/8" from the elevations, grades and cross sections on the drawings.
- E. Compacted full profile aggregate drainage stone base dimensions shall be a minimum of 8". The thickness of the finishing stone shall not exceed one (1) inch of compacted depth.
- F. It shall be the contractor's responsibility to maintain a uniform consistent stone base gradation during the installation process. This shall include but not limited to keeping aggregate base at optimum moisture content (5%, + 1%) and/ or providing, placing, and compacting a 1/2 " layer of stone chips.
- G. Installation shall be accomplished using automated laser grade control, equipment, with dual-slope capabilities.
- H. Prior to calling for grade verification from Landscape Architect, the contractor shall have a registered land surveyor establish and set PK nails at the following locations:
 - 1. Back of end zone.
 - 2. Goal line.
 - 3. Every 5 yard line.
 - 4. Football side line
 - 5. Soccer touch line
- I. PK nails, or equivalent, shall be placed on turf nailer system. Do not set flush into nailer. Allow enough to loop grade line onto nail for grade verification. String Check.
- J. Contractor shall have on-site, prior to Landscape Architect arrival, the following equipment:
 - 1. One (1) ton steel drum rover – rubber tired equipment not acceptable.
 - 2. 50 ton 3/8" stone chips.
 - 3. Topdresser – to distribute 3/8" stone chips.
 - 4. Two (2) 48"/38" aluminum landscape rakes.
 - 5. 24" wide broom.
 - 6. There must be enough personnel to operate all equipment simultaneously.
- K. It will be the contractor's obligation and responsibility to have all of the above items in place prior to grade verification by Landscape Architect.

3.3 COMPACTION REQUIREMENTS

- A. Sub-grade shall be compacted to not less than ninety-two percent (92%) of maximum density at not less than seventy-five percent (75%) of optimum moisture content.
- B. Aggregate drainage layer shall be compacted to not less than eighty-five percent (85%) of maximum density. Using conventional rolling equipment, moisture content shall not be less than ninety percent (90%) nor more than one hundred-ten percent (110%) of optimum moisture content. Using vibrating equipment, moisture content shall not be less than seventy-five (75%) of optimum moisture content.
- C. Maximum density shall be determined in accordance with AASHO Modified Method of Test for the Compaction and Density of Soil, Designation T-180, and the optimum moisture content shall be that corresponding to the maximum density in the above test.
- D. Contractor shall maintain optimum moisture content during the installation, (placement, grading, compacting, etc.) of the aggregate base materials.

3.4 ROLLERS

- A. Smooth steel-wheeled rollers shall be self-propelled and have a total weight not less than 8 tons. The compression (driving) roller shall exert a pressure of not less than 250 lbs. per inch width of the roller.
- B. Pneumatic-tire rollers shall have a compacting width of sixty (60) inches (1.5m) or more and shall be capable of varying the weight from 100 to 250 lbs. per inch of rolling width.

END OF SECTION 32 1124

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SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt paving.
2. Hot-mix asphalt paving overlay.
3. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: For each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the Michigan Department of Transportation.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of MDOT for asphalt paving work.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for oil-based materials 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.
- B. Tack Coat: AASHTO M 140 emulsified asphalt.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
 - 1. Color: Yellow for parking spaces.
 - 2. Color: Blue for barrier free spaces.
- C. Glass Beads: AASHTO M 247, Type 1.

2.4 STRIPING MATERIALS

- A. All striping shall be in accordance with the Michigan Manual on Uniform Traffic Control Devices.

2.5 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by the MDOT and complying with the following requirements:
 - 1. Base or Binder Course: MDOT 13A.
 - 2. Surface or Wearing Course: MDOT 13A.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
 - 1. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F (121 deg C).
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/4 inch (6 mm).
 - 2. Surface Course: Plus 1/8 inch (3 mm), no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch (6 mm).
 - 2. Surface Course: 1/8 inch (3 mm).
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 3 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 - 1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.
- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

**PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT**

**ASPHALT PAVING
32 1216 - 6
12/21/2022**

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 32 1216

SECTION 32 1313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
 - 5. Unit paver base.

- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete pavement mixture.
- C. Material Certificates: Signed by manufacturers certifying that each material complies with requirements:
- D. Minutes of preinstallation conference.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives of each entity directly concerned with concrete pavement, to attend conference:

1.4 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I/II, **[gray]** **[white]**. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
 - 1. Coarse Aggregate: MDOT 6A or MDOT 6AA.
 - 2. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 3. Fine Aggregate: MDOT 2NS.
 - 4. Do not use fine or coarse aggregates containing substances that cause spalling.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
- D. Water: ASTM C 94/C 94M.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Chemical Admixtures: ASTM C 494/C 494M, of type suitable for application, certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 3/4 inches long.
 - 1. Products:
 - a. Monofilament Fibers:
 - 1) FORTA Corporation; Forta Mono.
 - 2) Grace, W. R. & Co.--Conn.; Grace MicroFiber.

3) SI Concrete Systems; Fibermix Stealth.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers:
 - a. Bayer Corporation.
 - b. Conspec Marketing & Manufacturing Co., Inc.
 - c. Davis Colors.
 - d. Scofield, L. M. Company.
 - e. Solomon Colors.
 - 2. Color: As selected by Architect
- C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
 - b. Euclid Chemical Company (The); Surface Retarder S.
 - c. Scofield, L. M. Company; Lithotex.
 - d. Sika Corporation, Inc.; Rugasol-S.

- F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
 - 1. Products:
 - a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
 - b. Dayton Superior Corporation; Quartz Tuff.
 - c. Lambert Corporation; Colorhard.
 - d. Scofield, L. M. Company; Lithochrome Color Hardener.
 - e. Symons Corporation; Hard Top.
- G. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with FS TT-115, Type I or AASHTO M 248, Type F.
 - 1. Color: Blue for handicapped requirements, yellow elsewhere.

2.8 WHEEL STOPS

- A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
 - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 5-1/2 percent plus or minus 1.5 percent.
- B. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.
- C. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earth Moving."

3.2 INSTALLATION

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Edge Forms and Screed Construction: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
 - 1. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
 - 2. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. Joints, General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

2. Provide tie bars at sides of pavement strips where indicated.
 3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness to match jointing of existing adjacent concrete pavement.
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Concrete Placement: Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
1. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
 2. Do not add water to fresh concrete after testing.
 3. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
 4. Screed pavement surfaces with a straightedge and strike off.
 5. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
 6. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
 7. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

- a. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
8. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
9. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
10. Hot-Weather Placement: Comply with ACI 301 when hot-weather conditions exist:

3.7 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
- C. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in pavement surfaces as follows:
 1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- D. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on pavement surface. Tamp aggregate into plastic concrete, and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
 1. Spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- E. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on pavement surface according to manufacturer's written instructions.
 1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.

2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.
- F. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to pavement surface according to manufacturer's written instructions and as follows:
1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft, unless greater amount is recommended by manufacturer to match pavement color required.
 2. Uniformly distribute approximately two-thirds of dry-shake hardener over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second dry-shake hardener application, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed by power floating.
 3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete.
 4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.
- G. Penetrating Liquid Slab Treatment: Prepare, apply, and finish penetrating liquid slab treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these methods.

3.9 PAVEMENT MARKING

- A. Pavement Marking: Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
 1. Sweep and clean surface to eliminate loose material and dust.

2. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.10 WHEEL STOPS

- A. Wheel Stops: Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes drilled or cast into wheel stops at one-quarter to one-third points. Firmly bond each dowel to wheel stop and to pavement. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.11 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/4 inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

- a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1313

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SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Cold-applied, jet-fuel-resistant joint sealants.
3. Hot-applied joint sealants.
4. Hot-applied, jet-fuel-resistant joint sealants.

B. Related Sections:

1. Section 07 9200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Section 32 1313 "Concrete Paving" for constructing joints in concrete pavement.

1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, [eight] <Insert number>, Samples of materials that will contact or affect joint sealants. Use [ASTM C 1087] [manufacturer's standard test method] to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Product test reports.
- C. Preconstruction compatibility and adhesion test reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.
- C. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer[**or are below 40 deg F (5 deg C)**].
3. When joint substrates are wet.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: **[As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range] <Insert color>**.

2.2 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
 1. Products: Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Crafcoc Inc., an ERGON company; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
 - c. Pecora Corporation; 301 NS.
 - d. **<Insert manufacturer's name; product name or designation>**.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
 1. Products: Subject to compliance with requirements, provide one of the following:
 2. Products: Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Crafcoc Inc., an ERGON company; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Pecora Corporation; 300 SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Pecora Corporation; Urexpan NR-200.
 - b. **<Insert manufacturer's name; product name or designation>**.

2.3 COLD-APPLIED, JET-FUEL-RESISTANT JOINT SEALANTS

- A. Jet-Fuel-Resistant, Single-Component, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type S, Grade P, Class 25, for Use T.
 1. Products: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. BASF Building Systems; Sonomeric 1.
 - b. **<Insert manufacturer's name; product name or designation>**.
- B. Jet-Fuel-Resistant, Multicomponent, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 12-1/2, for Use T.
 1. Products: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Pecora Corporation; Urexpan NR-300.
 - b. **<Insert manufacturer's name; product name or designation>**.
- C. Jet-Fuel-Resistant, Multicomponent, Pourable, Traffic-Grade, Modified-Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.
 1. Products: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Meadows, W. R., Inc.; Sealtight Gardox.
 - b. **<Insert manufacturer's name; product name or designation>**.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.
 1. Products: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Crafcoc Inc., an ERGON company; Superseal 444/777.
 - b. **<Insert manufacturer's name; product name or designation>**.
- B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

1. Products: Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Meadows, W. R., Inc.; **[Sealtight Hi-Spec] [Sealtight 3405]**.
 - b. Right Pointe; D-3405 Hot Applied Sealant.
 - c. **<Insert manufacturer's name; product name or designation>**.

2.5 HOT-APPLIED, JET-FUEL-RESISTANT JOINT SEALANTS

- A. Hot-Applied, Jet-Fuel-Resistant, Single-Component Joint Sealant for Concrete: ASTM D 7116, Type I.
 1. Products: Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Crafcoc Inc., an ERGON company; Superseal 444/777.
 - b. **<Insert manufacturer's name; product name or designation>**.
- B. Hot-Applied, Jet-Fuel-Resistant, Single-Component Joint Sealant for Concrete and Tar Concrete: Single-component formulation complying with ASTM D 3581.
 1. Products: Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. Crafcoc Inc., an ERGON company; Superseal 1614A.
 - b. **<Insert manufacturer's name; product name or designation>**.

2.6 JOINT-SEALANT BACKER MATERIALS

- A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.7 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Cleaning of Joints: Clean out joints immediately before installing joint sealants.
- C. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- E. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- F. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place joint sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- H. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- I. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT

CONCRETE PAVING JOINT SEALANTS
32 1373 - 6
12/21/2022

END OF SECTION 32 1373

SECTION 32 1813 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes furnishing all labor, materials, tools and equipment necessary to install infilled synthetic turf system as indicated on the plans and as specified herein; including components and accessories required for a complete installation, including but not limited to:
1. Removal of existing natural grass turf surfacing
 2. Acceptance of prepared sub-base;
 3. Coordination with related trades to ensure a complete, integrated, and timely installation:
 4. Aggregate base course, sub-base material (tested for permeability), grading and
 5. compacting, piping and drain components; as provided under its respective trade section;
 6. Nailer board;
 7. Shock Pad.
 8. Installation of new synthetic grass surfacing and new infill.
 9. Protection of the existing running track and field event areas.

1.2 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this section. Other specification sections that directly relate to work of this Section include, but are not limited to:
1. Section 312000 – Earth Moving
 2. Section 312300 – Synthetic Field Equipment

1.3 REFERENCES

- A. ASTM – American Society for Testing and Materials.
1. D1577 - Standard Test Method for Linear Density of Textile Fiber
 2. D5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Covering
 3. D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Covering
 4. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
 5. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
 6. F1015 - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
 7. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
 8. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
 9. F355 - Standard Test Method for Shock-Absorbing Properties of Playing Surfaces.
 10. F1936 - Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field
 11. F2898 – Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface Systems by Non-Confined Area Flood

- B. Manufacturers Data and Recommended Installation Requirements
- C. National Federation of State High School Associations (NFSHSA)
- D. National Collegiate Athletic Association (NCAA)

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site at time to be determined by Owners Representative. Review methods and procedures related to installation including, but not limited to, the following:
 - 1. Inspect and discuss existing conditions and preparatory work performed under other contracts.
 - 2. Review Contractor's documentation of the condition of the existing track and review contractor's proposed plan to protect the existing track.
 - 3. In addition to the Contractor and the installer, arrange for the attendance of installers affected by the Work, the Owner's representative, and the Engineer.

1.5 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
 - 2. Submit fiber manufacturer's name, type of fiber and composition of fiber(s).
 - 3. Submit data in sufficient detail to indicate compliance with the contract documents.
 - 4. Submit manufacturer's instructions for installation.
 - 5. Submit manufacturer's instructions for maintenance and preventative maintenance of the synthetic turf system, including temporary painting and markings.
 - 6. Submit data on the manufacture's recommended maintenance equipment, including any attachments.
- B. Substitutions:

Other products are acceptable if in compliance with all requirements of these specifications. Submit alternate products to Architect or Engineer for approval prior to bidding in accordance Section 012500, Substitution Procedures.

 - 1. Provide all specifications, product data, certification and required information for the proposed alternate. It is the responsibility of the bidder to prove that the product substitution is equal to, or greater than, the product specified.
 - 2. Provide a sample (12"x12" min.) of the product substitution.
 - 3. Provide substantiation that proposed system does not violate any other manufacturer's patents, patents allowed or patents pending.
 - 4. Provide a sample copy of insured, non-prorated warranty and insurance policy Information.
- C. Comply with Section 013300, Submittals Procedures. Submit for approval prior to fabrication.
- D. Shop Drawings: For synthetic grass surfacing.

1. Field lining, markings and logos: Provide a complete scaled and dimensioned drawing of the inlaid or tufted in-field lines, marking plan, logos and details. Submittal shall include markings and colors for the following sports: MHSAA High School Football and MHSAA High School Soccer. Plans shall also include roll/seaming layout; methods of attachment, field openings and perimeter conditions.
 2. Show installation methods and construction indicating field verified conditions, clearances, measurements, terminations, drainage.
 3. Provide color information.
 4. Provide joint submission with related trades when requested by Engineer.
 5. Include sections and details.
 6. Show locations of seams and method of seaming.
 7. Show layout of any game lines, numbers, letters and logos. Indicate application method of each line and marking.
 8. Handhole box cover w/ non-wood lid material (prefer composite or metal). Indicate method of construction, turf piece adherence, temporary removal method, and infill containment.
- E. Samples:
1. With the Bid: Physical samples of all colors and shock pad sample.
 2. For each type of synthetic grass surfacing; 12" x 12" size for field areas, and 4" x 12" width for all stripes, letters, logos, color variations, etc.
 3. 1-gallon see-through bag(s) of specified infill mixture(s), clearly marked with contents, and mix ratio/percentages.
- F. Product Certification:
1. Submit manufacturer's certification that products and materials comply with requirements
 2. of the specifications. Submit test results indicating compliance with Reference Standards.
- G. Project Record Documents:
- Record actual locations of seams, drains, existing or proposed track radius monuments and other pertinent information in accordance with Specifications and General Requirements. Provide a copy of this information to the owner in both manual and electronic form.
- H. List of existing installations: Submit list of at least 20 outdoor installations in the State of Michigan over 65,000 sft, including respective Owner's representative contact information (name, title, telephone number, email, etc.).
- I. Submit Bills of Lading/Material Delivery Receipts for synthetic turf infill materials. Bills of lading shall bear the name of the project/delivery address, quantity of materials delivered, source/location of origin of infill materials and/or manufacturer, and date of delivery.
- J. Testing Certification: Submit certified copies of independent (third-party) laboratory reports on ASTM testing:
1. Pile Height, Face Weight & Total Fabric Weight, ASTM D5848.
 2. Primary & Secondary Backing Weights, ASTM D5848.
 3. Tuft Bind, ASTM D1335.
 4. Grab Tear Strength, ASTM D1682 or D5034.
 5. Water Permeability, ASTM D4491

- K. The Turf Vendor shall submit a document holding the Owner and its representatives harmless as to any liability and or costs of any type, including but not limited to legal costs, royalties, replacement costs, etc. associated with any claim by the Turf Vendor or others associated and with any patents or infringements of any current or future patent issued for the synthetic turf product, infill materials, installation methods or drainage characteristics. It is not the intent of these documents to promote or induce the use of intellectual property belonging to others or promote infringement of any known or currently not known patents, licenses or rights of others.
- L. Warranties: Submit a sample warranty at the time of bid and ensure that forms have been completed in Owner's name and registered with approved manufacturer. Policy must be in force at the time of bid.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The turf contractor and/or the turf manufacturer:
 - 1. Shall be experienced in the manufacture and installation of synthetic infill turf for a minimum of five years.
 - 2. Shall have 100 fields in North America in play for at least two years. Fields shall be 65,000 sft or more.
 - 3. Turf manufacturer shall have installed a minimum of 15 outdoor fields that are at least 8 years old, which is equal to the respective warranty period.
 - 4. Shall have a minimum of 20 outdoor installations in the State of Michigan.
- B. Installer Qualifications: Company shall specialize in performing the work of this section. The Contractor shall provide competent workmen skilled in this specific type of infilled synthetic turf installation, who are trained and approved by manufacturer.
 - 1. Installation team shall be an established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of five years' experience with 15 foot wide tufted materials
 - 2. Installation team shall be trained and certified, in writing, by the turf manufacture as competent in the installation of the specified material, including, inlays, seaming and proper installation of the infill mixture.
 - 3. The installer supervisor shall have a minimum of 5 years' experience as either a construction manager or a supervisor of synthetic turf installations and shall have at least 10 outdoor installations that are similar to this type of synthetic turf system.
- C. The Contractor shall verify special conditions required for the installation of the system.
- D. The Contractor shall notify the Engineer of any discrepancies.

1.8 WARRANTY

- A. See Section 01770 - Closeout Submittals, For Additional Warranty Requirements.
- B. The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the infilled synthetic turf system for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall include general wear and damage caused from UV degradation. Other items that must be included are: acceptable uses for the field, fading, color match within specifications, excessive fiber wear, wrinkling and panel movement, shock absorbency (Gmax), seam integrity, drainage (through the turf system only). The warranty shall specifically exclude vandalism, and acts of God beyond the control of the Owner or the manufacturer. The warranty shall be fully third party insured; prepaid for the entire eight (8) year term and be non-prorated. The Turf Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives from the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner notification in writing that the field is officially added to the annual policy coverage, guaranteeing the warranty to the Owner. The insurance policy must be underwritten by an "AM Best" A rated, or better, carrier and must reflect the following values:
 - 1. Maximum per claim coverage amount of fifteen million dollars (\$15,000,000).
 - 2. Minimum of fifteen million dollars (\$15,000,000) annual.
 - 3. Must cover full 100% replacement value of total square footage installed, minimum of seven dollars (\$7.00) per sft (in case of complete product failure, which will include removal and disposal of the existing surface).
 - 4. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
 - 5. Policy cannot include any form of deductible to be paid by the Owner.
- C. Pre-Paid eight (8) year insured warranty from a single source.
 - 1. Maximum per claim coverage amount of fifteen million dollars (\$15,000,000).
 - 2. Minimum of fifteen million dollars (\$15,000,000) annual.
 - 3. Must cover full 100% replacement value of total square footage installed, minimum of seven dollars (\$7.00) per sft (in case of complete product failure, which will include removal and disposal of the existing surface).
 - 4. Provide a sample copy of insured, non-prorated warranty and insurance policy information.
 - 5. Policy cannot include any form of deductible to be paid by the Owner.
- D. The artificial grass system must maintain a G-max of less than 165 for the life of the Warranty as per ASTM F355.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Prevent contact with materials that may cause dysfunction.
- B. Deliver and store components with labels intact and legible.
- C. Inspect all delivered materials and products to ensure they are undamaged and in good condition.
- D. Store materials/components in a safe place, protected from the elements, and elevated above grade.
- E. Protect from damage during delivery, storage, handling and installation. Protect from damage by other trades.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the Work with installation of work of related trades as the Work proceeds.
- B. Sequence the Work in order to prevent deterioration of installed system.

1.11 MAINTENANCE SERVICE

- A. The Contractor shall train the Owner's facility maintenance staff in the use of the turf manufacturer's recommended maintenance equipment.
- B. Manufacturer must provide 3 complete sets of the maintenance guidelines to the facility maintenance staff in both manual and electronic form that includes the turf provider's recommended procedures and materials for, but not limited to, general maintenance, line/marketing installation, small repair procedures, temporary marking paint application and removal, cleaning, etc.

PART 2 - PRODUCTS

2.1 SYNTHETIC GRASS SURFACING

- A. Approved manufacturers are as follows:
 - 1. Base Bid: FieldTurf USA, 175 N. Industrial Blvd, Calhoun, GA 30701, P: 800-724-2969,
 - a. Vertex
 - 2. AstroTurf Corporation, 2680 Abutment Road, SE, Dalton, GA 30721, P: 517-902-4453
 - 3. A-Turf, Inc, PO Box 157, Williamsville, NY 14231, P: 888-777-6910 Ex 1503
 - 4. Other alternative providers are acceptable and must meet and/or be equivalent to all listed requirements, qualifications and specifications.
- B. Alternates:
 - 1. Fieldturf, Revolution 360, Monofilament 2.25"
 - 2. Fieldturf, CORE, Monofilament
 - 3. Other alternates are acceptable.

2.2 MATERIALS AND PRODUCTS – Base Bid

- A. Synthetic Turf System shall consist of the following
 - 1. Synthetic Carpet
 - 2. Infill
 - 3. Shock Pad: ProPlay – EcoSport by Schimitz Foam Products or equivalent.

The installed fabric shall meet the following minimum physical properties:

STANDARD	PROPERTY	SPECIFICATION
ASTM D1577	Yarn Fiber Denier 1	12,000 +
ASTM D3218	Tape Thickness 1	360+ Microns
ASTM D1577	Yarn Fiber Denier 2	5,000+
ASTM D3218	Tape Thickness 2	100+ Microns
ASTM D3218	Min. Pile Height	2"
ASTM D5793	Stitch Gauge	3/8"-3/4"
ASTM D5848	Pile Weight	39oz/square yard
ASTM D5848	Primary Backing	7+oz/square yard
ASTM D5848	Secondary Backing	16+oz/square yard
ASTM D5848	Total Weight	57+oz/square yard
ASTM D1335	Tuft Bind (Without Infill)	8+ lbs.
ASTM D5034	Grab Tear (Width)	>200 lbs. /force
ASTM D5034	Grab Tear (Length)	>200 lbs. /force
ASTM D4491	Carpet Permeability	>30 inches/hour
ASTM F1936	Impact Attenuation (Gmax)	<200
Water Permeability		>40 inch/hour
Pile Yarn Type		UV-resistant polyethylene
Min. Infill Material Depth		1.5 inches
Minimum Sand Infill		2 lbs./ square foot
Minimum Rubber Infill		3 lbs./square foot
Total Product Weight		782+ oz./square yard

Variation of +/- 5% on above listed properties is within normal manufacturing tolerances

- B. The synthetic carpet shall consist of monofilament fibers tufted into a primary backing with a secondary backing. Pile height shall be nominal 2". Carpet Rolls shall be 15' wide.

1. Rolls shall be long enough to go from field sideline to sideline.
 2. Head seams, other than at the sidelines, are not acceptable.
 3. Field Layout (Basis for bid):
 - a. Alternating panels of colors "Green" and "Lime Green". The Team Box and the Endzone shall be, or closely matching the color "Hemlock Blue" (Pantone 7463 XGC, Cyan: 81, Magenta: 45, Yellow: 0, Black: 75). The Coaches Box and field markings shall be color "White". The Restricted Area shall be the color "Green". All turf areas outside the football playing field and restricted zone shall be color "Green".
- C. Backing:
1. Primary backing shall be a minimum double-layered polypropylene fabric.
 2. Secondary backing shall permanently lock the fiber tufts in place and shall consist of a polyurethane synthetic coating material.
 3. Perforated (with punched holes), backed carpet is required
- D. Fiber shall measure no less than 2 inches high.
1. The pile fiber angle shall be $90^{\circ} \pm 15^{\circ}$, measured from the horizontal, following the installation of the infill material.
- E. Infill materials shall be approved by the manufacturer.
1. The infill shall consist of a resilient-layered, granular system, comprising select graded silica sand and ambient SBR rubber.
 2. Minimum infill weight shall be 5.00 lbs.
- F. The sand infill will comply within the following characteristics:
1. Average Particle size between #20 and #40 mesh [calculated based on summing the midpoint of sieve pan fractions times the % retained on given screen fractions]
 2. Must be clean, sub-angular silica sand.
- G. The SBR rubber infill will comply within the following characteristics:
1. Average Particle size between #10 and #20 mesh [calculated based on summing the midpoint of sieve pan fractions times the % retained on given screen fractions]
 2. Must be ambient SBR Rubber.
- H. Markings: All markings shall be tufted in-place, inlaid or glued. The maximum amount of the markings shall be factory pre-fabricated into the turf system prior to shipment to the site. At a minimum all MHSAA Football markings (color "White") (with the exception of hash marks) shall be factory pre-fabricated. Other markings for the field shall include:
1. MHSAA High School Football Yard Markings shall be the color "White".
 2. Endzones shall be the color, or closely matching the color "Hemlock Navy Blue" with "White" lettering reading "HEMLOCK" in the North endzone and "HUSKIES" in the South endzone. Letters shall be ± 16 ft tall. Endzone text font shall closely match what's on the image below.
 3. Centerfield shall have the Hemlock Huskies Logo with the primary husky head in "Hemlock Navy Blue" color, and a "White" outline.
 4. See Below for field layout:

- I. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf manufacturer.
- J. Shock pad shall be designed specifically for outdoor athletic infill artificial turf fields with a minimum infiltration rate of 7 inch/hour and be designed for use over a draining stone base.
 - 1. Basis of Design: ProPlay – EcoSport by Schimitz Foam Products, made of thermal bonded (closed-cell) crosslinked polyethylene foam (XLPE):

Physical characteristics	Tolerance	ProPlay® Value	Unit	Standard
Thickness at 0.3 psi load	+/- 0.04	0.63	in	EN-ISO 9863-1
Mass per unit area	+/- 0.05	0.54	lb/ft ²	EN-ISO 9864
Strength characteristics	ProPlay® Value	Unit	Standard	
Tensile strength	38	psi	ASTM D 3575 (EN 12230)	
Compressive at 25% deflection	14	psi	ASTM D 3575	
• Thickness after 72 hour recovery	0.63	in	-	
Compressive at 50% deflection	45	psi	ASTM D 3575	
Thickness after 72 hour recovery	0.63	in	-	
Field performance characteristics	ProPlay® Value	Unit	Standard	
Impact attenuation (Gmax) in the field (Results will vary depending on the system and base)	80-110	-	ASTM F 1936 / F 355-A	
Performance characteristics	ProPlay® Value	Unit	Standard	
Water flow rate under 2 in (51 mm) hydraulic head	15	gpm/ft ²	ASTM D 4491 (EN ISO 11058)	
• (resulting) Water permeability by permittivity	4.7	gpm/ft ²	ASTM D 4491 (EN ISO 11058)	
In-plane water flow rate at 0.3 psi (2 kPa) load and 0.005 hydraulic gradient (0.5% slope)	0.05	gpm/ft	ASTM D 4716 (EN ISO 12958)	
• (resulting) Hydraulic transmissivity [θ]	10	gpm/ft	ASTM D 4716 (EN ISO 12958)	

Thermal conductivity [λ_{10}]	0.03	BTU/h.ft.°F	ASTM C 177 (EN 12667)
• (resulting) Thermal resistance [R-value]	1.8	h.ft².°F/BTU	ASTM C 177 (EN 12667)

2.3 QUALITY CONTROL IN MANUFACTURING

- A. The manufacturer shall own and operate its own manufacturing plant in North America. Both tufting of the field fibers into the backing materials and coating of the turf system must be done in-house by the turf manufacturer. Outsourcing of either is unacceptable.
- B. The manufacturer's full-time in-house certified inspectors shall perform pre-tufting fiber testing on tensile strength, elongation, tenacity, denier, shrinkage, and twist i.e., turns per inch, upon receipt of fiber spools from fiber manufacturer.
- C. The manufacturer shall have its own, in-house laboratory where samples of turf are retained and analyzed, based on standard industry tests, performed by full-time, in-house, certified inspectors.

2.4 FIELD GROOMER & SWEEPER

- A. Supply a turf specific field groomer and sweeper with magnet or single maintenance apparatus that performs both maintenance functions, as recommended by the turf manufacture.
- B. Maintenance apparatus shall include a towing attachment compatible with a standard field utility vehicle.
 - 1. Field Groomer shall include a towing attachment compatible with a field utility vehicle.
 - 2. Field Groomer shall be a FieldTurf GroomRight or equal.
 - 3. Field Sweeper shall include a towing attachment compatible with a field utility vehicle.
 - 4. Field Sweeper shall be a FieldTurf FieldSweep or equal.
- C.
- D. Game Lines and Markings: Provide game lines and markers in widths and colors according to requirements indicated on Drawings.
 - 1. Application Method: Tufted into the maximum extent practicable, with remaining lines inlaid.

2.5 MATERIALS

- A. SBR Rubber Infill: Rubber granules free of metal, nonmetal fibers, and contaminants; mesh size as recommended by synthetic grass surfacing manufacturer.
- B. Sand Infill: Uniformly sized silica sand free of silts, clays, and contaminants, and of subangular or rounder shape according to ASTM F 1632; mesh size as recommended by synthetic grass surfacing manufacturer.
- C. Fully sewn main turf seams and game lines and marking wherever possible.

- D. Seam Adhesive at game lines and markings:
- 2.6 One or two-part urethane, recommended or approved by synthetic grass surfacing manufacturer, and suitable for ambient conditions at time of installation.
- 2.7 Seam Tape: Synthetic grass manufacturer's recommended seam tape, minimum 12 inches (305 mm), and 18 inches (457 mm) wide for inlaid game lines.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine base and other conditions, with Installer present, for compliance with requirements for installation tolerances, permeability, and other conditions affecting performance of the Work.

3.2 INSTALLATION

- A. Avoid disturbance of base during installation of turf fabric.
- B. Roll out turf fabric and allow to relax at least four hours prior to seaming.
- C. Provide fully sewn main turf seams.
- D. Provide seams flat and snug, with no gaps or fraying. Remove yarns that are trapped within seams. Attach turf fabric to perimeter restraint system as recommended by the manufacturer.
- E. Install inlaid game lines and markings by cutting through turf fabric and installing snugly fitting game line turf fabric. Provide seaming tape that extends minimum 6 inches (152 mm) beyond seam.
- F. Repair loose seams and bubbles formed due to expansion of turf fabric prior to installation of infill.
- G. Evenly broadcast and groom infill by machine in proportions and depth after settling as recommended by the manufacturer, and to meet indicated performance requirements. Rake fibers trapped by infill to surface.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel in proper maintenance procedures for synthetic grass surfacing.

3.4 EQUIPMENT

- A. Provide grooming / maintenance equipment for field maintenance:
 - 1. Tow behind (using District's tractor)
 - 2. Electric lift

**PROJECT NO. 21113.60
HEMLOCK STADIUM TURF
HEMLOCK PUBLIC SCHOOL DISTRICT**

**SYNTHETIC GRASS SURFACING
32 1813 - 12
12/21/2022**

3. Synthetic Brushes
4. Spring tine rake combs
5. Magnet collector

END OF SECTION 32 1813

SECTION 32 1823.39 – SYNTHETIC RUNNING TRACK SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes all labor, materials, tools, equipment and services necessary for completing the installation of synthetic running track surface onto bituminous or concrete paved running track and field events as indicated.
- B. Related Sections include the following:
 - 1. Section 11 6833 "Athletic Equipment" for athletic equipment and events.
 - 2. Section 32 1216 "Bituminous Paving" for events on bituminous paved base.
 - 3. Section 32 1313 "Concrete Paving" for events on concrete paved base.
 - 4. Section 32 1823.41 "Track Calibrating and Marking" for calibration and marking of track.
- C. The Contractor shall pay all royalties and license fees. Contractor warrants that performance of its obligations under this Agreement will not infringe the patents, trademarks, copyrights, or other intellectual property rights of any third party and will otherwise comply with all applicable laws, regulations, ordinances, codes or other rules. Contractor agrees to defend, indemnify and hold harmless Owner and Architect from all suits or claims for damages or injunctive relief based on the alleged infringement by Contractor of any patents, trademarks, copyrights, or other intellectual property rights. Owner and Architect agree to promptly notify Contractor of any such suit or claim.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Samples: 12 by 12 inches (300 by 300 mm) minimum, of surfacing material, representative of thickness and color of actual installation.
- C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.

- E. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.
- F. Manufacturers Specifications: At the time of bidding, submit manufacturers product and installation specifications defining all materials and methods to be used in the construction of the track surface.
- G. Installer Certification: At the time of bidding, track surface installer shall provide certification of training from track surface manufacturer. Installer shall provide proof of three prior installations of the surface type specified with a current name and phone number of contact person at each installation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who meets all of the following qualifications.
 - 1. Minimum 10 years of experience;
 - 2. Has completed at least 10 surface installations in the last 3 years utilizing the system specified;
 - 3. Is a member of the American Sport Builders Association (ASBA).
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings" Review methods and procedures related to synthetic surfacing including, but not limited to, the following:
 - 1. Review condition of substrate and preparatory work performed by other trades.
 - 2. Review and finalize construction schedule for surfacing and related work. Verify availability of materials, Installer's personnel, and equipment required to execute the Work without delays.
 - 3. Review inspection and testing requirements, governing regulations, and proposed installation procedures.
 - 4. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
- C. Standards: The work shall be done in a thorough, workmanlike manner, and conform to standards for running track construction as prescribed in the most recently published version of the following documents.
 - 1. The National Federation of State High School Associations (NFHS), *Track and Field and Cross Country Rules Book*.
 - 2. U.S. Tennis Court and Track Builders Association (USTCTBA), *Track Construction Manual*.
 - 3. ASTM F2157-09 Standard Specification for Synthetic Surfaced Running Tracks.
- D. Layout of the Work: The work shall be laid out to true lines and grades. Surveying of lines and grades shall be from a benchmark established at the construction site.

1.5 SPECIAL PROJECT WARRANTY

- A. Warranty: Resilient track surface is to be guaranteed for a period of five (5) years against all defects in materials and workmanship, including such defects as bubbling, delamination, peeling, loss of integrity and excessive wear.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply materials if substrate is wet or excessively damp.

PART 2 - PRODUCTS

2.1 PHYSICAL PROPERTIES OF FINISHED TRACK SURFACE

- A. Surface Type: Latex w/ rubber granules. Base bid includes:
1. Base Latex Layer: SBR rubber granules between 2.0 to 5.0 millimeters with latex binder.
 2. Top Layers: EPDM rubber between 0.5 to 3.0 millimeters with latex binder. Binder-to-granules ratio to be minimum 67 percent rubber granules to maximum 33 percent latex binder.
 3. Alternate Materials: Other types of granules/system may be submitted for comparison of qualities and cost. At bid submission, include spreadsheet or other chart indicating and comparing features & cost difference of each alternate system proposed for review by Architect and Owner.
- B. Color: Navy – submit shop drawings with color options for review and approval.
- C. Thickness: Minimum 1/2" to be achieved with a minimum five (5) layer application, plus final texture layer.
- D. Cure Time: Each layer, approximately 24 hours in warm, dry ambient air conditions.

2.2 INSTALLERS

- A. Available Installation Companies: Subject to compliance with requirements, installers of synthetic running track surfaces that may be incorporated into the Work include, but are not limited to, the following:
1. A.G. Sports Services, LLC; www.allweathertracks.com
 2. Athletic Field Surfaces, Inc.; www.afstrack.com
 3. Current Surfaces, Inc.; www.currentsurfaces.com
 4. Goddard Coatings, www.goddardcoatings.com
 5. Kiefer USA; www.kieferusa.com
 6. SportMaster; www.sportmaster.net/running
 7. Star Trac Enterprise, www.startracbydougherty.com
 8. Vasco Sports; www.vasco-sports.thevascogroup.com
- B. Other Installers: Other companies that believe they also meet installation company requirements may submit their qualifications for review with their bid.

2.3 LINE MARKING PAINT

- A. The line marking paint shall be paint specifically manufactured to be compatible with synthetic track surfaces.

PART 3 - EXECUTION

3.1 SUB-BASE PREPARATION

- A. Substrate Acceptance: Synthetic running track surfacing system shall be laid only on a substrate of both base and top coat of bituminous pavement that has been approved by the synthetic running track surfacing contractor.
1. Survey: After both base and top coats of the bituminous pavement substrate have been laid, the installed finished grade shall be surveyed by the Contractor to confirm required dimensions prior to any synthetic running track surfacing application.
 2. Repair: Any discrepancies in the bituminous pavement substrate shall be completely resolved before synthetic running track surfacing proceeds.
 3. For certification the following tolerances must be achieved:
 - a. Bituminous Pavement Tolerance: The finished grade of the bituminous pavement top coat shall not vary under a 10-foot straight edge more than 1/8-inch.
 - b. Synthetic Running Track Surface Tolerances: The finish grade of the track surface shall not vary from planned cross slope by more than 0.1 percent with a maximum lateral slope outside to inside of 2.0 percent, and a maximum slope of 0.1 percent in any running direction.
- B. Flood Test: It shall be the responsibility of the bituminous paving contractor to perform a flood test of the top coat of bituminous pavement prior to review and acceptance by synthetic running track surface contractor.
1. Timing: Flood the surface immediately after the asphalt is capable of handling traffic, but no later than 24 hours after pour is complete.
 2. Repair: If, after 20-minutes of drying time, there are birdbaths evident, they shall be corrected in a way acceptable to the running track surfacing contractor.
 3. Notification: Contractor shall notify both Architect and Owner three (3) days minimum in advance of top coat of bituminous pavement pour so on-site inspection of surface can be scheduled.
- C. Bituminous Pavement Repair: The minimum depth of any bituminous pavement replacement shall be one-inch.
- D. Bituminous Pavement Curing Time: 14 to 28 days minimum to help ensure a clean, oil-free surface.
- E. Final Sub-Base Approval: It shall be the responsibility of the synthetic running track surfacing contractor to determine if the bituminous pavement substrate meets all design specifications including dimensions, cross slopes, planarity, and specific project criteria. After all the above conditions are met the synthetic surfacing contractor must – in writing – accept the dimensions, planarity of the bituminous pavement receiving base before work can commence.

3.2 CLEANING

- A. The area to be surfaced shall be clean and free of any loose or foreign substances (dirt, oil, etc.) prior to the commencement of the work. Contractor shall use a power blower, high-pressure washer, and/or other

methods acceptable to the bituminous pavement contractor so as not to damage the approved bituminous pavement finish surface.

3.3 SYNTHETIC RUNNING TRACK SURFACE APPLICATION

- A. The synthetic running track surface shall be applied in full accordance with manufacturer's requirements.
- B. Installation:
 - 1. Install 1/2-inch minimum total depth of material placed by applying a minimum of five (5) layers.
 - 2. After five layers have been applied, install texture layer on top.
 - 3. After texture layer is ready for striping, layout and apply painted lane markings, numbers and graphics as indicated
 - 4. After paint has sufficiently dried, apply final latex sealer to the finished track surface.
- C. Refer to other Division 2 sections for line marking requirements.

3.4 CLEAN UP

- A. Contractor shall be responsible for compliance with all local, state and federal codes of the storage, handling and disposing of materials.
- B. Material Remnants: Package and store a portion of remaining surplus material at location designated by Owner for their use in future light repairs. Include up to one 50-gallon drum of EPDM rubber granules matching those used in the top coats of the synthetic running track surface.

END OF SECTION 32 1823.39

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SECTION 32 1852 - PERFORMANCE SHOCK PAD

PART 1 - GENERAL

1.1 SUMMARY

- A. This section is part of the entire set of Contract Documents and shall be coordinated with the applicable provisions of the other parts.
- B. Related Sections:
 - 1. Section 32 1123 Aggregate Drainage Layer
 - 2. Section 32 1818 Synthetic Turf
- C. The work under this section of the Specifications is listed as Alternate No. L-2.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American Society for Testing and Materials (ASTM) , International Standards Organization (ISO) and European Committee for Standardization (EN): Alternates:
 - a. EN 12616 – Water Infiltration Rate
 - b. ISO 8295 – Plastic Film and Sheet – Determination of Coefficient of Friction
 - c. ISO 4897 – Cellular plastics - Determination of the coefficient of linear thermal expansion
 - d. ISO 8301 – Thermal Resistance
 - e. ISO 1798 – Standard Specification for Flexible Materials-Tensile Strength
 - f. ASTM F355 – Standard Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials
 - g. EN 14809 – Surfaces for sports areas - Determination of vertical deformation
 - h. ISO 1856 – Flexible cellular polymeric materials -- Determination of compression set
 - i. ASTM G22-76 – Determining the Resistance of Plastics to Bacteria
 - j. ASTM G21-96 – Determining Resistance of Synthetic Materials to Fungi
 - k. ESSM 105-d – Environmental Compatibility of Elastic Synthetic Surfaces on Sports Grounds
 - l. ASTM F925 – Test Method for Resistance to Chemicals of Resilient Flooring
- B. The sub-base (underlayment) material is to be manufactured in an ISO-9000 certified facility. No exceptions allowed.
- C. Company must demonstrate successful installations in the United States for at least 5 million sq. feet of manufacturers material.
- D. Use only new materials manufactured and shipped for the specific installation. No used or refurbished materials are to be installed. Manufacturer must provide documentation of material content and MSDS sheet for submittal package.
- E. Product to be shipped as flat panels on prepackaged pallets. Pallets to be wrapped with heavy-duty barrier for protection from moisture and UV exposure.

- F. Seams should be mechanically locked into place by hand without use of additional materials, glue, fasteners or secondary processes and equipment.
- G. Material must be installed using manufacturers guidelines, without exception.
- H. Manufacturer must provide written procedures to selected turf supplier for the installation of turf on top of underlayment.
- I. Turf Contractor must send G-Max test results to Underlayment manufacturer once completed.

1.3 SUBMITTALS

- A. General: Bidding contractor must identify performance base system with bid package. If a non-specified product is identified, the proposed alternate product must be submitted and pre-approved by the design architect/engineer 10 days prior to the bid opening. If bidding contractor does not identify a manufacturer, the Township/School District will assume that the specified product is included in the bid package and will not consider substitutions.
- B. Product Data: Submit 8" x 8" product sample and technical data sheet.
- C. Shop Drawings: Submit cross-sectional view showing product installation in relation to sub-base and synthetic turf (including edge attachment).
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
- E. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- F. Test Data: Submit listing of all applicable test data for compliance to specifications. All testing to be performed by independent sources following applicable ASTM or other internationally recognized standards and procedures.
- G. Installation: Submit copy of product installation instructions. Submit copy turf installation recommendations.
- H. Warranty: Submit copy of product 16 -Year warranty coverage.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
- B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the **<Insert product specified>** manufacturer for both installation and maintenance of units required for this Project.
 - 1. Engage an Installer who maintains a service center within sixty miles or two hours' travel time, of the Project site, and who can guarantee a response time of less than 24 hours to any Owner originated service call.

- C. Manufacturer Qualifications: Engage a firm experienced in manufacturing <Insert product specified > similar to those indicated for this Project and with a record of successful in-service performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. OPTION 1

1. Description: Expanded Polypropylene Composite
Product Requirements: An impact energy absorbing sub-base drainage material designed specifically for use with synthetic turf is required. The specified material must have both impact absorption and drainage properties that meet the following typical performance requirements
 - (a) Thickness: 0.55" (14mm) +/- 2mm
 - (b) Material Density 3.85 lbs/CF
 - (c) Area/Panel 15.9 SF/Panel
 - (d) Weight: 2.81 lbs/panel
 - (e) Permeability >50 in/hr
 - (f) Vertical Deformation <4 mm w/o turf overlay (EN14809)
 - (g) Product must be made in United States of America
 - (h) Product must be of a homogeneous material composition. Variable material content will not be accepted

B. OPTION 2

1. Description: Thermal Bonded (closed cell) Cross-Linked Polyethylene Foam
2. Product Requirements: An impact energy absorbing sub-base drainage material designed specifically for use with synthetic turf is required. The specified material must have both impact absorption and drainage properties that meet the following typical performance requirements.
 - a. Thickness: 0.79" (20mm) +/- 2mm
 - b. Material Density 0.82 lbs/SF
 - c. Area/Panel 23.1 SF/Panel
 - d. Permeability >1000 in/hr
 - e. Vertical Deformation <7 mm w/o turf overlay (EN14809)
 - f. Product must be made in United States of America

C. OPTION 3

1. Product Substitutions
 - a. Product substitutions are allowed only in accordance with pre-bid substitution request procedures outlined in the contract documents. No substitutions will be allowed after the bid date. Bidding contractor must identify performance base system with bid package. If a non-specified product is identified, the proposed alternate product must be submitted and pre-approved by the design architect/engineer 10 days prior to the bid opening. If bidding contractor does not identify a manufacturer, the Township/School District will assume that the specified product is included in the bid package and will not consider substitutions.

1.6 EXECUTION

A. INSTALLATION:

1. Finished aggregate base installation workmanship must be approved in advance by the pad manufacturer.
2. Manufacture shall provide written installation instructions and procedures and on-site supervision during material installation. On-site supervision will be waived if site contractor can provide 3 projects references demonstrating successful product installation.
3. Finished pad base installation workmanship must be approved in advance by the synthetic turf manufacturer. Approvals to be based on a physical inspection performed at the site prior to installation of any synthetic turf material.
4. Surplus Pad Material: Contractor shall provide a minimum 100 sf of surplus pad material.
5. Project Completion- Upon completion of installation, a walk-through will be conducted to inspect the quality of work and ensure all details meet specifications. A punch list of unacceptable or incomplete items will be documented and agreed upon for completion prior to final project closeout and acceptance.

END OF SECTION 32 1852

SECTION 32 8420 - WATER DISTRIBUTION SYSTEM - SYNTHETIC TURF

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
- B. This Section includes the following:
 - 1. Sleeving for the irrigation system (see drawing for size and type)
 - 2. Point of Connection: Contractor shall connect to existing irrigation mainline. Verify location in the field.

1.2 SCOPE

- A. Install a complete and working underground water distribution system according to plans and specifications provided.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Irrigation products shall be by a single manufacturer. All irrigation system components shall be supplied by the regionally authorized distributors to provide single source responsibility for

1.4 JOB CONDITIONS

- A. Site Conditions:
 - 1. The Contractor shall coordinate his work with that of other trades wherever possible.
 - a. Existing Utilities and Conditions
 - 1) Before excavation, the Contractor shall obtain location of all cables, conduits, sewers, septic tanks, and other utilities, and shall be cautions as not to damage them. If such obstacles conflict with the proposed work, the Contractor shall immediately notify the owner's representative for arrangements for relocation.
 - 2) In the event of damage, the contractor shall repair or replace these lines to the satisfaction of the Owner's Representative at no cost to the Owner.
 - 2. It is the Irrigation Contractor's responsibility to verify that all sleeving is installed under paving in locations as shown on drawings.

1.5 SUBMITTALS

- A. Submit manufacturer's data sheets for all materials (quick coupler valves, swing joints, pipe) and all other related items to owner's representative.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. QCV shall be manufactured by the Rainbird or approved equal.

2.2 MATERIALS

A. Pipe

1. PVC Pipe: All PVC pipe shall be pressure pipe as manufactured by J-M Manufacturing or Cresline Plastic Pipe Company. High-impact virgin polyvinyl-chloride (PVC-1120) conforming to NSF Standard 14 and ASTM D-2241 for thermoplastic pipe with minimum 160 PSI test strength. Pipe shall have standard thermoplastic pipe dimension ratio of SDR-26 and shall be marked with the manufacturer's name, materials, size and schedule. Pipe shall conform to the U.S. Department of Commerce Commercial Standard CS255-63-3408 or latest revision thereof. Pipe shall be suitable for potable water and shall bear the "NSF" trademark. See drawing for sizes specified.

B. Pipe Sleeves

1.

<u>Pipe Sleeve Size</u>	<u>Sleeve Size</u>	<u>Sleeve Type</u>
3/4" to 1"	2-inch	PVC 160 or Sch.40 DWV pipe
1-1/4" to 1-1/2"	3-inch	PVC 160 or Sch.40 DWV pipe
2" to 2-1/2"	4-inch	PVC 160 or Sch.40 DWV pipe
3 inch	6-inch	PVC 160 or Sch.40 DWV pipe
4 inch	8-inch	PVC 160 or Sch.40 DWV pipe
6 inch	10-inch	PVC 160 or Sch.40 DWV pipe

(Sleeve sizes and locations are based on a single pipe being installed in a sleeve. Contractor shall verify sleeve sizes with drawing.)

C. Fittings

1. PVC Pipe Fittings: All fittings 1-1/2" through 3" shall be Schedule 40 PVC solvent weld, type 1, meeting the requirements of ASTM D-2466. No saddles allowed. All 4" fittings shall be gasketed joint Harco PVC Class 200 meeting ASTM D1784 DR21 requirements. Bell shall be gasket joint conforming to ASTM3139 with gaskets conforming to ASTM F477. Fittings 6" and larger shall be Harco Ductile Iron Fittings manufactured with a grade of 65-45-12 in accordance with ASTM F-477 requirements.
2. Polyethylene Fittings: All fitting 1-1/4" and smaller downstream of control valve shall be plastic or insert type fittings where applicable. All 1-1/4" fittings shall be double clamped with all stainless steel worm gear clamps. All 1" and smaller fittings shall be clamped with all stainless steel worm gear clamps or all stainless steel crimp clamps.

- D. Quick Coupling Valves: Quick coupler valves shall be 1" one-piece brass body with a rubber cover as manufactured by Rainbird. Provide an equal number of quick coupler keys for number of quick coupler valves installed. Quick coupler keys shall also include fitting to allow for easy attachment to a standard garden hose.

- E. Solvent and Primer: Solvent and primer used on PVC pipe shall meet the requirements of ASTM D-2564 and shall be approved by the National Sanitation Foundation. All solvent and primer to be used in accordance with manufacturer's specification. Primer to be purple in color. Solvent shall be used to change its viscosity. If viscosity or consistency is unsuitable, the solvent shall not be used.
- F. Swing Joints:
 - 1. All sprinkler heads 6 GPM or less shall be attached to the piping with two-elbow joints consisting of 3/8" flexible pipe and coordinating elbows.
 - 2. All quick coupling valves shall be installed using a galvanized swing joint assembly consisting of three galvanized nipples (2) 2"; (1) 4" and (1) 12". Size shall match inlet size of quick coupling valve.
- G. Quick Coupler Valve Monument Box:
 - 1. Quick coupler valves shall be housed in a pre-manufactured stainless steel box. Synthetic turf shall be affixed to lid to create a flush surface.
 - a. Single QCV Box - Springfield Specialties - TC-3700-OCV Plus X total

PART 3 - EXECUTION

3.1 Layout and Staking

- A. Piping Layout: Piping layout is diagrammatic and contractor shall verify site conditions.
- B. Staking: All quick coupler valves and mainline line routing shall be staked prior to installation for approval upon request of the Owner's Representative.

3.2 TRENCHING

- A. Trenches shall be excavated so that irrigation lines are installed with the following minimum depths for pipe cover:
 - 1. 1. All polyethylene lateral pipe: Minimum depth - 15".
 - 2. 2. All PVC lateral pipe 3/4" and 1": Minimum depth - 12".
 - 3. 3. All PVC pipe: Depth is specified below:
 - a. 1-1/2" - 2" pipe size 16" cover
 - b. 2 1/2" - 4" pipe size 20" cover
 - c. 6" - 8" pipe size 24" cover
 - d. 10" pipe size 30" cover
 - 4. All wire:
 - a. 115V power wire - 24" or as required by code.
 - b. 24V control wire - 14" or as required by code.
 - c. Hydraulic control tubing - 14" minimum.
- B. All PVC piping shall be trenched. PVC pipe 2-1/2" and smaller may be pulled with approval of owner's representative if proper soil conditions exist and minimum depth requirements are maintained.

- C. Polyethylene distribution pipe may be pulled, with approval of owner's representative, if proper soil conditions and minimum depth requirements are maintained.
- D. Trench excavation in excess of required depth shall have bottom graded and tamped prior to any pipe replacement.
- E. Where trenching of PVC or polyethylene pipe lines is not possible because of adverse soil conditions or obstructions, and backbone operation is required, provide labor, materials and equipment for this operation, including full trench backfilling with soil if required in operation of owner's representative. Restoration of the area, as directed by owner's representative. It shall be part of this contract and shall be performed in the following manner:
 - 1. Return to grade with native soil. Backfill material shall be free from debris, including rocks, large stones, clay clumps or other unsuitable substances and care shall be taken to prevent settling and damage to pipe during and after backfilling operations. When backfilling, soil shall be tamped in 6-inch layers with minimum of 6 inches of acceptable soil in turf areas and 12 inches in plant bed areas.
- F. Depth of sleeves shall be as noted on installation and details on drawing.
- G. Pavement: Where existing pavement must be cut to install irrigation system, cut smoothly in straight lines 6 inches wider than trench.
 - 1. Excavate to required depth and width.
 - 2. Remove cut-out pavement and excavated material from the site.
 - 3. Backfill with dry sand fill material, placing in 6-inch lifts.
 - 4. Repair or replace pavement cuts with equivalent materials and finishes.
 - 5. At walkways, jack piping under pavement material, if possible.

3.3 INSTALLATION

- A. A. General: Unless otherwise indicated, comply with requirements of Uniform Plumbing Code.
- B. Piping:
 - 1. All mainlines and headers shall be kept to a minimum to 2 feet from all existing or proposed trees.
 - 2. Polyethylene pipe connectors shall be made with insert fittings held tightly in place with worm gear driven stainless steel clamps and screws at ferrules. Pipe sizes 1-1/4" and larger in diameter shall be double clamped.
 - 3. PVC pipe shall be laid on solid undisturbed soil or on thoroughly compacted full bed of sand so as to assure full bedding, proper alignment and minimum slope for drainage.
 - 4. PVC pipe ends and PVC fittings shall be thoroughly cleaned for full depth of fitting with liquid cement. Method of application shall be in accordance with manufacturer's recommendations for solvent weld connectors.
 - 5. Lay pipe on solid subbase, uniformly sloped without humps or depressions.

6. Install PVC pipe in dry weather when temperature is above 40°F (4 degrees C) in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperature above 40°F (4 degrees C) before testing, unless otherwise recommended by manufacturer.

C. Connection to Water Source: Point of connection shall be as indicated on drawings. Contractor shall verify point of connection with owner's representative.

D. On synthetic turf applications, monument box shall abut concrete turf anchor.

3.4 THRUST BLOCKS

A. Provide concrete thrust blocks on side of mainline pipe wherever pipe changes direction at tees, bends, or dead ends, and at any other location where thrust is to be expected.

B. Refer to pipe manufacturer's recommendations for type and method of thrust blocks.

3.5 BALANCE AND ADJUSTMENT

A. The contractor shall flush all lines and evacuate all air and debris from the system. After completion, testing and acceptance of the system, instruct the owner in the operation and maintenance of the system.

3.6 MAINTENANCE, GUARANTEE AND WARRANTY

A. Contractor shall provide two (2) brass quick coupler keys with swivels to Owner that match system installed. System installed shall allow Owner to attach garden hose or water cannon to quick coupler key.

B. A full two (2) year manufacturer's warranty on all quick coupler valves shall be provided by the Irrigation Contractor. Any part proven to be defective within the 2 year warranty period shall be replaced with no cost to the owner for parts. After the 1 year labor warranty has expired, the owner shall be responsible for the labor to replace defective materials.

END OF SECTION 32 8420

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SECTION 32 9200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.
- C. Seed Mix

1.3 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 1. Pesticide Applicator: State licensed, commercial.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.5 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin watering and maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue watering and maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species for non-athletic areas: State-certified seed of grass species as follows:
 - 1. Maximum 25 percent Perennial Ryegrass
 - 2. Minimum 25 percent Fescue varieties
 - 3. Minimum 50 percent Kentucky Bluegrass, 2 varieties.
- C. Seed Species for athletic field: State-certified seed of grass species as follows:
 - 1. Rhino Seed Premium Sports 80/20 mix
 - 2. 20 percent each of Elite Kentucky Bluegrass types
 - 3. 20 percent Turf Type Perennial Rye Grass

2.2 FERTILIZERS

- A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium, by weight. Or as recommended by soil testing lab.

2.3 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content Existing, in-place surface , or imported topsoil or manufactured topsoil from off-site sources; do not obtain from agricultural land, bogs or marshes. Verify suitability of soil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix soil with amendments and fertilizers

2.4 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch(25-mm) sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
- C. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

- D. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 TURF AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches(200 mm). Remove stones larger than [2 inches(50 mm)] <Insert size> in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 - 2. Spread planting soil to a depth of 6 inches(150 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches(150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches(150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
 - a. Apply fertilizer directly to surface soil before loosening.
 - 3. Remove stones larger than 2 inches(50 mm) in any dimension and sticks, roots, trash, and other extraneous matter.
 - 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch(13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph(8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.(2.3 to 3.6 kg/92.9 sq. m).
- C. Rake seed lightly into top 1/8 inch(3 mm) of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas from hot, dry weather or drying winds by applying straw mulch or hydromulch within 4 hours after completing seeding operations. Scatter straw mulch uniformly to a minimum thickness of 1-1/2 inches(33 mm) to form a continuous blanket. Spread by hand, blower, or other suitable equipment. Water mulch immediately after spreading.

3.3 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials, installation and watering the same as those used in the original installation. Keep newly planted areas watered until satisfactory turf is establish.
- B. Provide temporary watering materials; holes, temporary piping, sprinkler, etc., as needed to establish lawn
- C. Mow turf as soon as top growth is tall enough to cut. Repeat watering and mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft.(0.92 sq. m) and bare spots not exceeding 5 by 5 inches(125 by 125 mm).
- B. Use specified materials to reestablish turf that does not comply with requirements and continue watering and maintenance until turf is satisfactory.

END OF SECTION 32 9200

SECTION 33 4100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For underground structures. Include plans, elevations, sections, details, and frames, covers, and grates.
- C. Field quality-control test reports.

1.3 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76(ASTM C76M), Class III, with bell-and-spigot ends, and gasketed joints with ASTM C 443(ASTM C 443M), rubber gaskets.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.6 CLEANOUTS

- A. Description: Cast-iron cleanout with threaded adjustable housing, flanged ferrule, brass cleanout plug, and round cast-iron heavy-duty, secured, scoriated cover. Wade Model 6000Z-75-179 or equivalent.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB Manufacturing Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Wade Div.; Tyler Pipe.
 - e. Zurn Industries, Inc.; Zurn Specification Drainage Operation.
 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.7 MANHOLES

- A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 5. Top Section: Eccentric-cone type unless flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Individual FRP steps, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

10. Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange and 26-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

2.8 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.9 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 1. Diameter: 48 inches minimum, unless otherwise indicated.
 2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
 4. Riser Sections: 4-inch minimum thickness, and of length to provide depth indicated.
 5. Top Section: Eccentric-cone type unless flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 6. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 8. Steps: Individual FRP steps, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 9. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
 10. Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange. Provide grates as indicated on drawings.
 - a. Material: ASTM A 536, Grade 60-40-18 ductile iron, unless otherwise indicated.

2.10 DRAIN INLETS

- A. Precast Concrete Catch Basins: ASTM C 76, precast reinforced concrete sewer pipe, of depth indicated. Base section shall have minimum thickness of 4-inches, riser sections shall have minimum thickness of 3 inches and be 24 inches inside diameter.
- B. Frames and Grates: ASTM A 536, Grade 60-40-18 heavy-duty, ductile-iron, sewer pipe bell flange. Refer to drawings for cover types.

2.11 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregular size and shape, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - 1. Average Size: NSSGA No. R-5, screen opening 5 inches.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, backfilling, and warning tapes are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
- B. Gravity-Flow, Nonpressure Sewer Piping: Refer to plans for materials:

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 - 2. Install piping below frost line.
 - 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 4. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.4 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
 - 2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1/8" inch above surrounding grade.
- C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops as indicated on the plans.

3.7 CATCH BASIN INSTALLATION

- A. General: Install catch basins, complete with appurtenances and accessories indicated.
- B. Install precast concrete sections with sealants according to ASTM C 891.
- C. Set tops of frames and covers at elevations indicated.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's storm building drains specified in Division 22.
- B. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work and with municipal storm system requirements.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 4100

SECTION 33 4600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes subdrainage systems for foundations, retaining walls, and landscaped areas.
- B. Related Sections include the following:
 - 1. Division 07 waterproofing Sections for molded-sheet drainage panels.

1.2 SUBMITTALS

- A. Product Data: For each type of drainage panel indicated.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings:
 - 1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 - 2. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.
- B. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.
 - 1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.
- C. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
 - 1. Gaskets: ASTM F 477, elastomeric seal.

2.4 SPECIAL PIPE COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.
- B. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.6 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.7 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
 - 1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
 - 2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.
- B. Underslab Subdrainage Piping:
 - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
 - 2. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

- C. Header Piping:
 - 1. PE drainage tubing and fittings, couplings, and coupled joints.
 - 2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 - 1. At Grade in Earth: PVC cleanouts.
 - 2. At Grade in Paved Areas: Cast-iron cleanouts.
- B. In Underslab Subdrainage Piping:
 - 1. In Equipment Rooms and Unfinished Areas: Cast-iron cleanouts.
 - 2. In Finished Areas: Copper-alloy cleanouts.

3.4 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- F. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and 6 inches above top of pipe and extend to cover minimum 6 inches of bottom of drainage panel.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

3.5 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches between drainage pipe and

trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- F. Add drainage course to width of at least 6 inches on both sides and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.

3.6 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive or tape.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.
- E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.
- G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.7 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive or tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.8 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 - 1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 42 inches, unless otherwise indicated.
 - 2. Underslab Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent.
 - 3. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow 36 inches unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
 - 4. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches, unless otherwise indicated.
 - 5. Lay perforated pipe with perforations down.
 - 6. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.
- D. Install PVC piping according to ASTM D 2321.

3.9 PIPE JOINT CONSTRUCTION

- A. Cast-Iron Soil Pipe and Fittings: Hub and spigot, with rubber compression gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.
- B. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- C. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- D. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.
- E. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.
- F. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.10 CLEANOUT INSTALLATION

- A. Cleanouts for Foundation Subdrainage:
 - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in nonvehicular-traffic areas.
 - 3. In nonvehicular-traffic areas, use PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches in depth. Set top of cleanout plug 1 inch above grade.
- B. Cleanouts for Underslab Subdrainage:
 - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 - 2. Use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.11 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

3.12 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping.
 - 1. Install PE warning tape or detectable warning tape over ferrous piping.
 - 2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

- A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.14 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 4600

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SECTION 33 4605 – SUBDRAINAGE SYSTEMS – FLAT DRAINTILE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section is a part of the entire set of Contract Documents, and shall be coordinated as such. This section includes:
 - 1. Subdrainage systems for synthetic turf areas.
- B. Related Sections include the following:
 - 1. 1. Section 31 2010 Earthwork (Turf)
 - 2. 2. Section 31 3219 Geotextile Fabric
 - 3. 3. Section 32 1818 Synthetic Turf

1.2 SCOPE

- A. The work under this section consists of furnishing all labor, materials and equipment to install the drainage system, couplings and accessories for the artificial turf subdrainage system..

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. 1. American Society for Testing and Materials (ASTM):
 - a. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - b. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 - 2. American Association of State Highway and Transportation Officials (AASHTO):
 - a. AASHTO M294 – Standard Specification for Corrugated Polyethylene Pipe

1.4 SUBMITTALS

- A. Product Data: For each type of drainage panel indicated.
- B. Manufacturer's Literature: Furnish to Landscape Architect, copies of manufacturer's specifications, maintenance, and installation instructions for each item specified herein. Include photographs, catalogue cuts, and other data as may be required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 DRAINTILE

- A. High Density corrugated polyethylene (HDPE), tubular-style perforated type, pipe and fittings.
- B. Hancor "HI-Q", ADS N-12, or approved equal.
- C. Diameter of systems lateral and collector lines as shown on plans.

2.2 DRAINTILE – FLAT DRAIN

- A. AdvanEDGE pipe with geotextile sock manufactured by Advanced Drainage Systems, Inc. (800) 733-9554. Size as indicated on Drawings.
- B. Multi-Flow manufactured by Varicore Technologies, Inc., (800) 978-8007. Size as indicated on Drawings.

2.3 TRENCH MATERIAL

- A. Filter Aggregate: Evenly graded mixture of ¾" diameter clean crushed stone.
1.

PART 3 - EXECUTION

3.1 INSTALLATION FOR CORRUGATED POLYETHYLENE TUBING

- A. Hand trim excavating to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage drain tile.
- B. Place a two inch (2") thick bed of filter aggregate.
- C. Install the drainage tile on the filter aggregate bed.
- D. Ensure complete connection to storm sewer using perforated pipe.
- E. Cover the pipe with filter aggregate to top of trench and compact to 90% Modified Proctor.

3.2 INSTALLATION FOR CORRUGATED POLYETHYLENE TUBING

- A. Install flat drain pipe horizontally, being sure to allow for a minimum of 8" of stone below turf material.
- B. Joints shall be made using manufacturers couplers prior to placing flat drain on subgrade. Use 2 coupling pins for each coupler. Couplers shall be placed under the fabric at the joint to prevent backfill infiltration. To accomplish this, split the fabric seam and lay back the fabric approximately 8". Install the coupler with 2 pins. Replace fabric over the coupler and secure the fabric with suitable tape.

- C. End caps shall be used at all termination points to prevent soil infiltration into system.
- D. Compact stone to appropriate modified proctor density value.

3.3 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

END OF SECTION 33 4605

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