
ISSUED JULY 3, 2025

HUNGER SOLUTION CENTER

ADDITIONS & RENOVATIONS

940 E. GENESEE AVE., SAGINAW, MI 48607

BID OPENING
AUGUST 14, 2025 @ 1:30 P.M.

PRE-BID MEETING
AUGUST 7, 2025 @ 1:30 P.M.



SECTION 00 0100

PROJECT DIRECTORY

PROJECT: Hunger Solution Center
Additions & Renovations

PROJECT LOCATION: Hunger Solution Center
940 E. Genesee Ave.
Saginaw, MI 48607

CONSTRUCTION MANAGER: R.C. Hendrick & Son, Inc.
2885 S. Graham Road
Saginaw, MI 48609
989.781.8116 (Phone)
989.781.9512 (Fax)

OWNER'S REPRESENTATIVE: Earl Soules - PM / OR Hunger Solutions Expansion Project
Hunger Solution Center
940 E. Genesee Ave.
Saginaw, MI 48607
989.859.6465 (Phone)

ARCHITECT: TSSF Architects, Inc.
122 N. Washington Avenue
Saginaw, MI 48607

END OF SECTION 00 0100

SECTION 00 0110

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END OF SECTION 00 0110

SECTION 00 1000

ADVERTISEMENT FOR BID

Notice is hereby given that Hunger Solution Center is receiving bids from trade contractors for the following project:

HUNGER SOLUTION CENTER - ADDITIONS & RENOVATIONS

Complete proposals will be received for the following work categories in accordance with drawings and specifications as prepared by the Architect, Engineers and Construction Manager.

BID CATEGORY 1:	EARTHWORK AND SITE UTILITIES
BID CATEGORY 2:	ASPHALT PAVING / STRIPING
BID CATEGORY 3:	LANDSCAPE IRRIGATION
BID CATEGORY 4:	LAWNS AND PLANTINGS
BID CATEGORY 5:	CONCRETE WORK
BID CATEGORY 6:	MASONRY
BID CATEGORY 7:	STRUCTURAL STEEL AND MISCELLANEOUS IRON
BID CATEGORY 8:	GENERAL TRADES WORK
BID CATEGORY 9:	WATER PROOFING
BID CATEGORY 10:	MEMBRANE ROOFING AND ASPHALT SHINGLES
BID CATEGORY 11:	GLASS AND GLAZING
BID CATEGORY 12:	DRYWALL AND ACOUSTICAL
BID CATEGORY 13:	PAINTING AND COATINGS
BID CATEGORY 14:	KITCHEN EQUIPMENT
BID CATEGORY 15:	FIRE SUPPRESSION
BID CATEGORY 16:	MECHANICAL WORK
BID CATEGORY 17:	ELECTRICAL WORK
BID CATEGORY 18:	FENCING

Bids will be received at the Hunger Solution Center until **1:30 p.m. on Thursday, August 14th, 2025** at which time the bids will be privately opened. Bids may not be withdrawn for a period of ninety (90) days after the bid date.

Proposals should be submitted in TRIPLICATE, mailed or hand carried and be addressed to:

Earl Soules - PM / OR Hunger Solutions Expansion Project
Hunger Solution Center
940 E. Genesee Ave.
Saginaw, MI 48607

R.C. Hendrick & Son, Inc. is the Construction Manager on this Project. Please do not phone, fax, or email bids to the Construction Manager.

DAVIS-BACON WAGES APPLY TO THIS PROJECT

See attached Davis-Bacon Wage Rates for Saginaw County. (8 pages)

OWNERS RESERVATION OF RIGHTS

The Owner reserves the right to reject any, part of any or all bids and to waive all informalities in the bidding procedures. The Owner reserves the right to reject any bid when Bidder fails to submit data required by the Bidding Documents, or if the bid is submitted incomplete or irregular. No telephonic, email, fax bids or modification to a submitted bid will be received or considered by the Owner.

PRE-BID CONFERENCE

A pre-bid meeting and walk through will be held on **Thursday, August 7th, 2025 at 1:30 p.m.** at Hunger Solution Center, 940 E. Genesee Ave., Saginaw, MI 48607.

QUESTIONS / RFIs

All questions regarding the plans and specifications are to be emailed to Chip Hendrick (chip@rchendrick.com).

DRAWINGS AND SPECIFICATIONS

Plans, Specifications and Addendums will be available for download from the R.C. Hendrick Plan Room located at www.rchendrick.com. Click on "Plan Room" and then follow the link to access the project files.

ADDENDUMS

Addendums will be posted to R.C. Hendrick's Online Plan Room. Addendums will be posted no later than 12:00 Noon on the day before the bid is due. R.C. Hendrick will send out a notice that an addendum is available to all known planholders. **It is the responsibility of every bidder to check the project site for addendums and note them on the bid form.**

END OF SECTION 00 1000

"General Decision Number: MI20250097 07/18/2025

Superseded General Decision Number: MI20240097

State: Michigan

Construction Type: Building

County: Saginaw County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/03/2025
1	01/24/2025

2	02/21/2025
3	04/04/2025
4	05/23/2025
5	06/06/2025
6	07/04/2025
7	07/11/2025
8	07/18/2025

* ASBE0047-002 07/01/2025

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 40.00	23.65

BOIL0169-001 07/01/2025

	Rates	Fringes
BOILERMAKER.....	\$ 43.50	36.74

BRMI0009-001 08/01/2024

	Rates	Fringes
BRICKLAYER.....	\$ 35.14	24.20
PLASTERER.....	\$ 33.01	24.54
TILE FINISHER.....	\$ 26.24	21.13
TILE SETTER.....	\$ 31.43	21.13

FOOTNOTE:

Paid Holiday: Fourth of July, if the worker is employed by the contractor in any period of seven working days before said holiday within the current calendar year.

CARP0706-004 06/01/2024

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation & Drywall Hanging; Excluding Form Work)....	\$ 33.11	23.64

CARP1045-003 06/01/2013

	Rates	Fringes
LATHER.....	\$ 24.29	13.66

ELEC0557-001 06/01/2024

	Rates	Fringes
ELECTRICIAN		
Alarm Installation.....	\$ 30.25	20%+8.95
Excluding Alarm Installation.....	\$ 39.50	38.05% +10.00

ENGI0324-016 06/01/2024

	Rates	Fringes

OPERATOR: Power Equipment

GROUP 1.....	\$ 47.28	25.25
GROUP 2.....	\$ 43.93	25.25
GROUP 3.....	\$ 41.28	25.25
GROUP 4.....	\$ 39.57	25.25
GROUP 5.....	\$ 39.57	25.25
GROUP 6.....	\$ 33.71	25.25
GROUP 7.....	\$ 31.23	25.25

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: \$1.50 per hour above the group 1 rate. Crane operator with main boom and jib 400' or longer: \$3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Concrete Pump; Crane; Grader/Blade; Highlift; Hoist; Roller; Scraper; Stiff Leg Derrick; Trencher

GROUP 4: Bobcat/Skid Loader; Broom/Sweeper; Fork Truck (over 20' lift)

GROUP 5: Boom Truck (non-swinging)

GROUP 6: Fork Truck (20' lift and under for masonry work)

GROUP 7: Oiler

IRON0025-019 06/01/2024

	Rates	Fringes

IRONWORKER

REINFORCING.....	\$ 33.43	37.15
STRUCTURAL.....	\$ 35.55	35.83

LAB00334-010 06/01/2025

	Rates	Fringes

LABORER: Landscape and Irrigation

GROUP 1.....	\$ 29.93	9.10
GROUP 2.....	\$ 27.71	9.10

CLASSIFICATIONS

GROUP 1: Landscape specialist, including air, gas and diesel equipment operator, lawn sprinkler installer and skidsteer (or equivalent)

GROUP 2: Landscape laborer: small power tool operator, material mover, truck driver and lawn sprinkler installer

tender

LAB01098-009 07/01/2024

	Rates	Fringes

LABORER

Common or General; Grade
Checker; Mason Tender -
Brick/Cement/Concrete;

Pipelayer.....	\$ 26.20	13.45
Sandblaster.....	\$ 27.33	13.45

PAIN1803-002 06/01/2025

	Rates	Fringes

PAINTER: Brush and Spray.....	\$ 28.77	21.67
PAINTER: Drywall Finishing/Taping.....	\$ 28.77	21.77

PLAS0016-012 04/01/2014

	Rates	Fringes

CEMENT MASON/CONCRETE FINISHER...	\$ 25.47	12.38

PLUM0085-003 05/01/2025

	Rates	Fringes

PIPEFITTER, Includes HVAC Pipe and Unit Installation.....	\$ 46.00	22.99
PLUMBER, Excludes HVAC Pipe and Unit Installation.....	\$ 46.00	22.99

ROOF0149-003 06/01/2024

	Rates	Fringes

ROOFER.....	\$ 30.38	19.87

SFMI0669-001 01/01/2025

	Rates	Fringes

SPRINKLER FITTER (Fire Sprinklers).....	\$ 41.34	27.39

SHEE0007-009 05/01/2018

	Rates	Fringes

SHEET METAL WORKER (Including HVAC Duct Installation; Excluding HVAC System Installation).....	\$ 26.83	23.78

* SUMI2011-022 02/01/2011

	Rates	Fringes

CARPENTER (Form Work Only).....	\$ 16.50 **	1.65

FLOOR LAYER: Vinyl Flooring.....\$ 16.81 **	3.73
IRONWORKER, ORNAMENTAL.....\$ 18.48	7.93
OPERATOR:	
Backhoe/Excavator/Trackhoe.....\$ 18.31	13.84
OPERATOR: Bulldozer.....\$ 17.50 **	8.67
OPERATOR: Tractor.....\$ 19.10	8.48
OPERATOR: Loader.....\$ 17.62 **	0.00
PAINTER: Roller.....\$ 22.02	6.02
TRUCK DRIVER, Includes Dump and Tandem Truck.....\$ 12.00 **	0.00
TRUCK DRIVER: Tractor Haul Truck.....\$ 13.57 **	1.18

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.75) or 13658 (\$13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the

type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the

interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

SECTION 00 2000

INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

Definitions set forth in the General Conditions of the Contract Construction, AIA Document A201 – Current Edition, and in other contract documents are applicable to the Bidding Documents.

Bidding Documents: Bidding Documents include the Drawings, Specifications, Addenda prepared by the Architects, Engineers, Consultants and Construction Manager and anything referenced within those documents.

Addenda: Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

Bid: A bid is a complete and properly signed proposal to do the work for a stipulated sum, submitted in accordance with the Bidding Documents.

Base Bid: The sum stated in the Bid Form for which the Bidder offers to perform the work described in the Bidding Documents as the Base Bid.

Alternate: An alternate is an amount stated in the Bid to be added or deducted from the Base Bid if the corresponding change in the work, as described in the Bidding Documents, is accepted.

Unit Price: An amount stated as a price per unit of measurements for materials or services described in the Bidding Documents.

Bidder: A person or entity who submits a bid.

Furnish: This term is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.

Install: The term is used to describe operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

Provide: To furnish and install, complete and ready for the intended use.

2. CONSTRUCTION MANAGER

R.C. Hendrick & Son, Inc. has been selected by the Owner to organize and direct the complete construction of the project and, as such, will act as a representative of the Owner in those matters so designated.

3. BIDDING PROCEDURE

R.C. Hendrick's online Plan Room is the official location for all bidding documents. **It is each bidder's responsibility to ensure that they have viewed all addenda posted to the Plan Room.** Addendums will be posted no later than 12:00 Noon on the day before the bid is due.

Bidders are to bid COMPLETE Bid Categories only. Bids for partial categories or noting any exceptions may cause your bid to be rejected. If you feel that something is part of your category that should not be included, please submit a Pre-Bid RFI.

Bidders shall include all work noted in the Bid Category Description as well as General Bid Category Notes which apply to ALL Categories.

Each Bidder by submitting this Bid to the Owner represents that they have read and understand the Bidding Documents. Each bidder also represents that they have made a site inspection, familiarized themselves with the local conditions under which the work is to be performed, and have correlated observations with requirements of the Bidding Documents.

Bids shall be submitted in TRIPLICATE. (1) One Original and (2) Two Copies of the Bid Form are required. Fill in ALL blanks on the bid form. Information must be typed or in ink. Express sums in both words and figures. The amount in words will govern in case of a discrepancy. The signer of the bid must initial all interlineations, alterations and erasures.

Enclose the bid and other documents required in a sealed envelope. If the Bid is sent by mail, enclose the sealed envelope in a separate mailing envelope with "Sealed Bid Enclosed" printed on the envelope.

Address the envelope to the party receiving the bids and state project name, the bidder's name and address, and the designated Bid Category # for which the bid is submitted on the outside of the envelope. If you are bidding on more than one Bid Category, each bid must be in its own **clearly marked** envelope.

Bids will be **PRIVATELY** opened approximately (15) fifteen minutes after the deadline to submit bids. Only properly identified bids received on time will be opened.

4. COMBINED BIDS

If you intend on offering a discount as part of a Combined Bid, you **MUST** submit a base bid in each category and each category **MUST** be in a separate envelope. The Combined Bid must be entered on at least one Bid Form submitted by the bidder.

5. ALTERNATES

Alternates are listed on the Bid Form and are described in further detail in the Architectural Specification. Each bidder should review all Alternates and determine if what is described in the Specification and shown on the Drawings causes an addition or deduction to their Base Bid. Bidders shall indicate on the Bid Form if the Alternate is an ADD or DEDUCT to the Base Bid and indicate the costs associated. If the Alternate does not affect your scope of work, enter "No Change" in the space provided. The Owner will have the right to accept Alternates in any order or combination and to determine the low bidder on the basis of the sum of the base bid and the accepted Alternate. Alternate pricing shall be held for 180 days from bid date.

6. VOLUNTARY ALTERNATES

The bidder may submit voluntary alternates with their bid. Voluntary Alternates are changes in scope or a specification. Voluntary alternates shall be listed in the appropriate space on the Bid Form. If additional pages are necessary, attach them to the end of the Bid Form on your company letterhead. Voluntary alternates will be reviewed after the award of a contract and the Owner reserves the right to accept or reject any Voluntary Alternate.

7. QUESTIONS AND DISCREPENCIES

Notify the Construction Manager at least five (5) days prior to bid of ambiguities, inconsistencies, or error discovered upon examination of the Bidding Documents, site or local conditions. Submit requests for clarification or interpretation of the Bidding Documents in writing. Interpretation, correction, or change of the Bidding Documents will be made by Addendum, all other forms will be non-binding. Questions should be EMAILED to the Project Manager listed in the R.C. Hendrick Online Plan Room.

8. SUBSTITUTIONS

The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality. Pre-Bid substitution requests must be submitted in writing and received by the CM at least ten (10) days prior to bid date. The burden of proof of the merit of the proposed substitute is upon the proposer. The Owner's decision of acceptance or rejection of a proposed substitution will be final.

See specification section 01 6000 – Product Requirements for Substitution Request Form.

9. MODIFICATION OR WITHDRAWAL OF A BID

A bid may not be modified or withdrawn following the time and date designated for the receipt of bids. Prior to the time and date designated for receipt of bids, a submitted bid may be withdrawn by notice to the party receiving bids at the place designated for receipt of bids. Notice shall be in writing over the signature of the bidder or in person. Withdrawal notice shall be submitted by mail, telegram, or fax postmarked on or before the date and time for receipt of bids. Withdrawn bids may be resubmitted up to the time designated for the receipt of bids.

10. OWNER'S RESERVATION OF RIGHTS

The Owner reserves the right to reject any, part of any or all bids and to waive all informalities in the bidding procedures. The Owner reserves the right to reject any bid when Bidder fails to submit data required by the Bidding Documents, or if the bid is submitted incomplete or irregular. No telephonic, telegraphic, email, fax bids or modification to a submitted bid will be received or considered by the Owner.

The Owner will have the right to accept Alternates in any order or combination and to determine the low bidder on the basis of the sum of the base bid and the accepted Alternate.

It is the Owner's intent to award a contract to the lowest responsible and competent bidder provided the bid has been submitted in accordance with the requirements of the bidding documents and does not exceed the funds available for construction.

The Owner reserves the right to cancel the project and contract at any point. The contractor will be reimbursed for work performed up to cancellation based upon the amount of work completed.

11. SUBSURFACE MATERIALS AND SOIL BORINGS

Contractors may review test-boring data if it is available. Soil Boring data will be available either as a part of the specification or will be available as a separate file in the Electronic Plan Room. The Owner, CM, or Architect as part of Contract Drawings or Specification does not guarantee its accuracy or completeness. Contractor shall assume all responsibility in excavating for this project and shall not rely on subsurface information obtained for CM. Bidders shall make their own investigation of existing subsurface conditions; neither Owner, CM, nor Architect will be responsible in any way for additional compensation for excavation work performed under the contract due to Contractor's assumptions based on subsoil data prepared solely for Owner's and Architect's use.

12. BONDS

Bid Bond (N/A)

Each bid which exceeds \$50,000 must be submitted with an attached certified check, money order, or a bid bond from a surety company approved to do business in the State of Michigan, payable to the **Owner** in an amount not less than 5% of the base bid sum of the work.

Performance Bond & Labor and Material Payment Bond (See Alternate #2)

Prior to the execution of the contract, furnish bonds covering the faithful performance of the contract and the payment of all obligations arising there under. Include cost of bonds in the base bid. The bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of their power of attorney.

13. POST BID INFORMATION

The Bidder shall within seven (7) days of notification of selection for the award of the Contract for the work, submit the following information.

- A. Designation of the Work to be performed by the Bidder with his own forces.
- B. Proprietary names and the suppliers of principal items or systems of materials and equipment proposed for the Work.
- C. List of names of the subcontractors or other persons or entities (including those who are to furnish materials or equipment fabricated to the special design) proposed for the principal portions of the Work.
- D. A list of proposed job site staff and home office staff directly involved with this Project. Indicate the qualifications, pay rates, titles, responsibilities, and duties of each person.
- E. Certificates evidencing insurance coverage in the amounts and types specified.
- F. An interim construction schedule in a bar graph format.
- G. A completed Schedule of Values in the format provided by the Owner.

The Bidder will be required to establish to the satisfaction of the Owner, the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

Prior to the award of the Contract, the Bidder will be notified in writing. If the Owner has reasonable objection to any proposed person or entity, the Bidder may at his option, (1) withdraw his bid or (2) submit an acceptable substitute person or entity with an adjustment in cost occasioned by such substitution. The Owner may at his discretion, accept the adjusted bid price or disqualify the Bidder.

The Owner reserves the right to request financial statements from the bidder before the award of a contract.

14. PRE-AWARD INTERVIEW

The selected Contractor as determined by the Owner will be required to attend a pre-contract award interview at the job site office of R.C. Hendrick & Son, Inc. for the purpose of reviewing the submitted bid for compliance with specified products, methods of installation, warranties, general job procedures, post bid information and related items.

Meeting minutes of the pre-contract interview will be taken by a representative of R.C. Hendrick & Son, Inc. Before concluding the interview, the minutes will be signed by those in attendance.

15. TAXES

Each bidder shall include in their proposal, and agree to pay, all fees and taxes including Sales and Use which they may be required to pay in connection with the performance of the contract. Also, the bidder includes and agrees to pay for all contributions to unemployment compensation, health and welfare, appropriate benefits, or other purposes now or hereafter during the term of the contract and the Owner and Construction Manager shall not be liable for any additional charges.

16. INDEMNIFICATION AND GENERAL LIABILITY INSURANCE

Each trade contractor shall agree to indemnify and hold harmless the Owner, Architect and R.C. Hendrick from and against any and all general liability claims whatsoever arising out of or occurring during and occasioned directly or indirectly by its negligence or fault. Prior to entering into a contract, each trade contractor shall provide evidence satisfactory to the Owner, Architect and R.C. Hendrick of adequate general liability insurance coverage which names the Owner, Architect and R.C. Hendrick as additional insured. Each trade contractor shall also provide evidence of Worker's Compensation Insurance in the amounts required by the State of Michigan.

17. LOCAL PRODUCTS

All prime bidders, subcontractors and suppliers shall utilize products that are local to the region or State whenever possible where price, quality and performance are equal to or better than non-local products.

18. MINORITY SUBCONTRACTORS

Bidders are encouraged to use the services of minority subcontractors if possible in the pursuance of this project.

19. NON-COLLUSION CLAUSE

By submitting and signing the proposal form, the bidder declares that neither the bidding firm nor agents of the bidding firm or any other members of the proposed team have entered into any collusion or agreement concerning any aspect of the proposal.

20. CONSTRUCTION DOCUMENT RESPONSIBILITIES

All bidders are responsible for the COMPLETE set of drawings and specifications including the CM Issued Front-End, Technical Specifications (Architectural, Mechanical, and Electrical), Drawings (Civil, Structural, Architectural, Mechanical, Electrical, etc.). Bidders are to familiarize themselves with the work of other trades and participate in the coordination of work activities.

All bidders are to include, in their entirety, the work and instructions described in Division 0 – "Bidding and Contract Requirements" and Division 1 – "General Requirements."

21. WARRANTY

All work shall be guaranteed for a period of twelve (12) months from the date of substantial completion of the entire Bid Package unless more specifically stated in the contract documents. All service during this 12-month period shall be rendered without charge to the Owner. This 12-month warranty does not replace any longer warranties required by the specification.

22. SITE VISIT

All contractors are required to visit the site to familiarize themselves with existing conditions either through the Pre-Bid Conference or through a visit you have scheduled with R.C. Hendrick. Contractors shall not visit or walk through the site without permission from R.C. Hendrick.

23. FORMAT OF ELECTRONIC SUBMITTALS

When submitting information electronically all contractors shall use the Portable Document Format (.pdf) for all email attachments. Forms and requests that are submitted in a different format may be rejected resulting in delays to the schedule and payments.

24. ADDITIONAL SETS OF DRAWINGS AND SPECS

The Owner will not furnish additional sets to the successful bidder(s). Contractors will need to purchase or reproduce additional sets of plans and specifications at their own expense.

END OF SECTION 00 2000

SECTION 00 2200

BID CATEGORY GENERAL NOTES

The following are General Notes that apply to all bid categories.

1. **All bid categories are to include all sections in Division 0 and Division 1 in their entirety.**
2. Full compliance with all the safety regulations and requirements of Federal OSHA, MIOSHA, State Authorities, Local Authorities and the Construction Manager. Failure to do so will cause this contractor to be removed from the site. (Hard Hats and Work Boots must be worn at all times.)
3. We will be using an online system called BuildingBlok for all submittals. Contractors must upload all submittals to this online system. Refer to Specification section 01 3300 - Submittal Procedures. RCH will hold one training session for contractors not familiar with the program. There is no cost incurred by contractors for using this online system.
4. Recycling of demolished materials by the Contractor and Subcontractor is encouraged provided that the materials are not marked on the drawings or in the specification to be salvaged and returned to the Owner. Any expected recycling earnings by the Contractor or Subcontractor should be reflected in their bid pricing. Recycled materials are not to be stockpiled and must be removed at least weekly from the site. Individual recycling ("dumpster diving") of demolished materials is not permitted on site.
5. Smoking and use of Drugs or Alcohol on School property is strictly prohibited!
6. **The maximum allowable markup on Changes in the Work shall be ten percent (10%) which includes overhead, profit, estimating expenses, other office expense, and insurance costs.**
7. Each Contractor shall furnish and maintain a trash receptacle, clearly marked with their company name in the vicinity of every work area for their daily use.
8. Contractor and Employee name shall be placed on all hard hats.
9. Drinking water is the responsibility of contractors for their crews.
10. Contractors are required to perform daily and weekly cleanup as defined in Specification Section 017100. This to include proper dust control as generated by their construction activities. Dumpsters provided by owner. No concrete, wood pallets, cardboard, or masonry.
11. Contact "Miss Dig" three days prior to any excavations.
12. All contractors are to cooperate with testing agencies hired by the owner. This to include advance notification to the construction manager of activities requiring testing (Compaction, soil bearing, concrete, steel, etc.). Additional costs associated with failed tests will be passed on to the contractor whose work did not pass.

13. This project will require permits and inspections from the State of Michigan (BCC). Fire inspection will be required by the State of Michigan (BFS). Contractors shall pull permits and schedule inspections as required by the governing authority.
14. Each contractor is responsible for all layout and field dimensions associated with their work.
15. Contractors shall remove mud and debris from streets and walks as a result of their work activities and deliveries.
16. Fill out and turn in a Daily Report on BuildingBlok for every day as well as uploading a signed weekly "tool box talk."
17. Upload all start up documents to BuildingBlok within 10 working days from receipt of Notice to Proceed. Startup documents to include signed contracts, Schedule of Values, Certificate of Insurance, Shop Drawings and Submittals, Contractors Safety Program and Current SDS Files.
18. **Contractors are to review all drawings & notes, including civil, architectural, structural, mechanical and electrical, and include all work as defined in their respective bid category.**
19. Include sales tax and bond premiums in base bids.
20. Contractors are to put forth their best effort to protect existing finishes and newly installed products from damage.
21. Provide all lifting, hoisting, scaffolding, etc. as required for the full installation of your work. Schedule deliveries during normal working hours.
22. Contractors **must have foreman** attend weekly job progress meetings while on site and when requested by R.C. Hendrick & Son, Inc.
23. Contractor-supplied materials shall be stored in contractor provided storage units unless arrangements are made with the Construction Manager in advance.
24. R.C. Hendrick & Son, Inc. **will not** unload materials for any contractor.
25. All contractors are to participate in keeping the site secure at the end of each workday. Contractors are to shut windows/doors and lock gates at the end of each workday.
26. All openings made by contractors shall be covered and maintained by the contractor creating the opening until permanent finishes are installed.
27. Firestopping of openings in walls shall be done by the contractor who created the opening.
28. The owner and construction manager shall obtain and pay for a building permit only. All other permits are to be obtained and paid for by contractors as required for their work.

END OF SECTION 00 2200

SECTION 00 2400

BID CATEGORY DESCRIPTIONS

BID CATEGORY #1

EARTHWORK AND SITE UTILITIES

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

02110 Site Clearing
02225 Minor Demolition for Remodeling (Related to the Site)
02274 Soil Erosion Prevention and Sedimentation Control
02300 Earthwork
02660 Water Distribution
02722 Storm Sewerage System
02732 Sanitary Sewer

Bid Category Notes (Including, but not limited to):

1. Protect all open excavations per MIOSHA requirements.
2. Furnish, install and maintain all soil erosion measures for the duration of the project. Pay for Soil Erosion Permit. Provide a storm water operator to review soil erosion measures as required. SESC book shall be kept on site and filled out weekly and/or after each event as required by the soil erosion permit.
3. Keep site graded and accessible to contractors.
4. All demolition debris is to be hauled off site and disposed of properly.
5. Include all site demolition, concrete removal, saw cutting, asphalt removal, asphalt crushing or milling, trees, shrubs, etc. as indicated or required for new Sitework. This to include all site demolition up to face of buildings.
6. Install utility piping as shown or called for within five (5) feet of building entrance point. Final connections shall be coordinated with mechanical contractor and Civil Engineer.
7. Provide and install connections to existing and new downspouts if shown or called for.
8. Provide all excavation, shoring, grading, compaction, backfill, berms and off-site fill to final subgrade elevations as shown or specified, including backfill required around foundation walls, retaining walls, sidewalks, drives, equipment pads, light pole bases, etc. This to include rough and final grading to +/- .10 foot below bottom of finish paving. Provide extra material for fine grading by others as needed.

9. Provide all dewatering (ground and rain water) as necessary to perform the work within this package.
10. Obtain and pay for all required permits, bonds, etc. as necessary to perform the work within this bid category.
11. No changes in grade or line are allowed without approval of the Construction Manager or Architect/Engineer.
12. Furnish and install all sleeves passing under walks, driveways, etc.
- 13. Area roadways are to be kept clean of dirt and debris generated by construction activity.**
14. Provide all barricading as required to meet state and local codes during tie in of new work to existing roadways and sidewalks. Barricades shall be left in place until completion of asphalt.
15. Provide periodic compaction of owner supplied dumpsters at the request of the CM.
16. Provide all saw cuts for tie in to existing drives and sidewalks.
17. Include all layout for this category.
18. Include excavation for light pole bases if shown.
19. Include excavation for pipe bollards if shown.
20. Provide extra stone for paving final grade as needed.
21. Furnish and install all aggregate base under asphalt paving.

BID CATEGORY #2

ASPHALT PAVING / STRIPING

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

02740 Flexible Pavement

Bid Category Notes (Including, but not limited to):

1. Fine grade aggregate base prior to installation of base course.
2. Include all pavement markings.
3. Bid category 1 will provide extra material ***if*** needed for fine grading of asphalt areas.
4. Clean up loose asphalt particles upon completion of each course of asphalt placement.
5. Include all barricading and flagging as necessary.
6. Provide and install parking lot signage if shown on plans.
7. Include all layout for this category.

Work by Others:

1. Additional material needed for fine grading of new asphalt areas.

BID CATEGORY #3

LANDSCAPE IRRIGATION

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements

Division 01 General Requirements

02811 Landscape Irrigation

Bid Category Notes (Including, but not limited to):

1. Complete all landscape irrigation complete per plans and specifications.

BID CATEGORY #4

LAWNS AND PLANTINGS

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements

Division 01 General Requirements

02900 Planting

Bid Category Notes (Including, but not limited to):

1. Provide, place and fine grade topsoil upon completion of work activities. Provide seeding or hydroseeding to disturbed areas as per plans and specifications.
2. Include restoration of lawns after removal of soil erosion controls.
3. All plantings should be nursery grade and per local growing zones.
4. Provide commercial grade edging at landscaped areas if called for on plans and specifications.

BID CATEGORY #5

CONCRETE WORK

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
02750	Rigid Pavement
03050	Basic Concrete Materials and Methods

Bid Category Notes (Including, but not limited to):

1. Furnish, form, and install all concrete for footings, foundations, slabs on grade, concrete decks, equipment pads, etc.
2. Review civil drawings and include ALL concrete work as shown or called for.
3. Coordinate installation of footings with local inspector to ensure proper inspection prior to placement of footings.
4. Provide proper curing and sealing of concrete as shown or specified. Include sealer for all exposed concrete floors as specified.
5. Provide and install all reinforcing as shown or specified. Provide proper rebar protection as required by MIOSHA.
6. Protect all exposed finishes during installation of this work.
7. Form and pour all light pole base as shown or called for. Excavation is by others.
8. Provide and install concrete joint sealants as shown.
9. Provide and install all exterior concrete.
10. Provide grouting and setting of base plates.
11. Include install pipe bollards.
12. Include pipe bollard plastic sleeve.
13. Install all trench drains.
14. Furnish and install all concrete shown on drawings.
15. All polished concrete that is called out on the plans and specs shall be by this contractor.

BID CATEGORY #6

MASONRY

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
04065	Masonry Mortar and Grout
04270	Glass Block Units
04810	Unit Masonry
07210	Building Insulation (Behind Masonry)

Bid Category Notes (Including, but not limited to):

1. Contractor is to provide wall bracing plans to the Construction Manager prior to start of work. Wall bracing plans must be approved by a structural engineer as required by MIOSHA.
2. Provide proper bracing of walls as required by MIOSHA and the Masonry Institute. **Current MIOSHA standards MUST be followed at ALL times.** Provide proper barricades and signage as required by MIOSHA during construction of wall through completion of structural steel joists and deck. Signage and barricading shall not be removed until CM approves.
3. **It is the intent of the CM that the bulk of masonry work is completed prior to cold weather so all costs associated with winter protection of masonry construction shall be on a T&M basis.**
4. Receive, unload and install all metal embedded lintels, anchors, bearing plates, etc. as supplied by others and installed in masonry.
5. Furnish and install brick, glass block, block, stone veneer assemblies, concrete masonry units, architectural precast concrete, through wall flashing, anchors, weeps, vents and other accessories as necessary for a complete system.
6. Furnish and install horizontal and vertical wall reinforcement where shown or specified.
7. Provide shop drawings showing placement of reinforcing steel.
8. Provide mockup of block/brick wall assemblies as specified. This to be made within 30 days of issuance of contract.
9. Furnish and install all openings and chases as work progresses. This bid category is to review architectural, mechanical and electrical drawings on a daily basis and notify other trades of items passing through walls to ensure proper openings and locations of openings are created during the construction of the wall and to notify CM of required lintels in advance of wall construction.
10. Furnish and install all insulation associated with masonry and/or cast stone including but not limited to safig at masonry cavities and where masonry walls extend to deck.
11. Provide and install fill in of block work around structural steel, metal deck and misc. items upon their installation to create fire rating as shown or specified.
12. Include all water repellant coatings for brick, CMU and architectural precast concrete units as shown or specified.

BID CATEGORY #7

STRUCTURAL STEEL AND MISCELLANEOUS IRON

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

05120 Structural Steel
05500 Metal Fabrications

Bid Category Notes (Including, but not limited to):

1. Furnish and install all metals and furnish only items installed by Bid Category #6.
2. All unloading by this contractor for metals included in Bid Category #7.

BID CATEGORY #8

GENERAL TRADES WORK

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
02225	Minor Demolition for Remodeling (Related to the Building)
02820	Fences and Gates (Roof Screening on Building)
06100	Rough Carpentry
06173	Wood Trusses
06200	Finish Carpentry
07468	Metal Siding
07710	Roof Edging / Fascia
07900	Joint Sealers
08110	Steel Doors and Frames
08330	Rolling Grilles - Open Design
08332	Overhead Coiling Doors
08360	Overhead Doors
08710	Door Hardware
09770	Special Wall Surfacing (Fiberglass Reinforced Plastic Panels)
10523	Fire Extinguishers and Cabinets
10800	Toilet, Bath, and Laundry Accessories
11130	Dock Seals
11160	Hydraulic Dock Leveler
11165	Hydraulic Dock Lift

Bid Category Notes (Including, but not limited to):

1. This bid category to provide dust control for their activities, cutting, and driving equipment around the site. Dust to be kept minimized at all times.
2. Provide grouting of hollow metal frames if required.
3. Provide all interior and exterior caulking of control joints, corners, lintels, door frames in masonry walls.
4. Provide all architectural demolition as shown or specified. Provide and install shoring as required.
5. Furnish all layout for this bid category.
6. Provide and install all exterior and interior rough and finish carpentry items including frames, nailers, blocking, plywood sheathing, etc.

7. Provide demolition of flooring where shown or specified. Includes adhesive/mastic removal as necessary. Prep shall be completed by the flooring contractor as required.
8. Furnish all embedded anchors and bolts for attachment of carpentry to masonry or concrete.
9. Furnish all fasteners necessary for all work included in this bid category.
10. Provide wood or sheet metal blocking in gypsum walls for toilet partitions, markerboards/tackboards, casework, and any miscellaneous accessories requiring such as shown on drawings.
11. Provide and install all door hardware for doors supplied by this bid category.
12. Provide and install all permanent fire extinguishers and cabinets. Provide startup inspection and tagging if shown on drawings.
13. Provide and install all hollow metal door frames, hollow metal doors, wood doors, and associated hardware.
14. Provide and install toilet and bath accessories.
15. Furnish & Install Vinyl Fence (Screening) on roof.

BID CATEGORY #9

WATERPROOFING

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

07132 Self-Adhering Sheet Waterproofing

Bid Category Notes (Including, but not limited to):

1. Complete work as shown on plans and specifications.
2. Include clean up for your own work.

BID CATEGORY #10

MEMBRANE ROOFING AND ASPHALT SHINGLES

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

07311 Asphalt Shingles
07530 Elastomeric Membrane Roofing
07620 Sheet Metal Flashing and Trim
07710 Roof Edging / Fascia
07723 Roof Hatches

Bid Category Notes (Including, but not limited to):

1. Include all work complete including any temporary protection and clean up.
2. To address leaks at the parapet wall at the front of the building, replace with new membrane flashing and sheet metal coping as noted on the drawings.

BID CATEGORY #11

GLASS AND GLAZING

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
08422	Sliding Automatic Entrances
08710	Door Hardware (for Aluminum Openings)
08800	Glazing

Bid Category Notes (Including, but not limited to):

1. Furnish and install all aluminum entrances, sliding automatic entrance doors, associated door hardware, and storefronts as shown or specified.
2. Furnish and install all glazing.
3. Remove all stickers, labels and excess caulking from glass and frames upon completion.
4. Include all sealants to complete this work, glass to aluminum, aluminum to aluminum, aluminum to adjacent surfaces, interior and exterior
5. Provide and install all door hardware on doors supplied by this contractor. Where automatic door openers are to be installed, provide and install low voltage wiring and controls for a workable system. Automatic door operators to include push pads, door controls, and wiring necessary to make the system operational. Coordinate AC power with electrician.
6. Include all metal angles, clips, fasteners, shims, etc. required for complete installation.
7. Furnish and install aluminum covers, sills, mullions, trim, etc. where aluminum systems abut other finishes and/or are shown to incorporate structural members.
8. Provide all field measurements for your work.
9. Provide all hoisting, lifting and storage materials.
10. Furnish and install insulation behind aluminum systems as shown or specified.

BID CATEGORY #12

DRYWALL AND ACOUSTICAL

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
07210	Building Insulation (at Non-Masonry Exterior Finishes)
07214	Foamed-In-Place Insulation
07218	Spray Insulation
07276	Fluid Applied Membrane Air/Waterproofing Barriers
09260	Gypsum Board Assemblies
09510	Acoustical Ceilings

Bid Category Notes (Including, but not limited to):

1. Provide all hoisting, lifting and storage of materials.
2. Furnish and install all metal framing, drywall, and insulation.
3. Provide minor touch up of drywall finishes following primer application and prior to finish painting.
4. Install access panels in acoustical soffits and/or walls as needed. Provide if shown.
5. Provide and install drywall soffits as shown or specified.
6. Provide ceiling tile to other trades for installation of their work. (i.e. sprinkler heads, cameras, smoke detectors, lighting, etc.)
7. Provide and install ceiling grid system.
8. Provide sealants for this scope of work.
9. Install joint sealants where drywall abuts other materials for a smooth transition.
10. Provide patching existing walls to be ready for paint as needed.
11. Include Z-furring and rigid insulation for exterior walls.

BID CATEGORY #13

PAINTINGS AND COATINGS

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

09900 Paints and Coatings

Bid Category Notes (Including, but not limited to):

1. Include painting of exposed steel, mechanical, electrical, etc. as shown or specified.
2. Include all interior and exterior painting as shown or specified.
3. Include "minor" scraping of masonry walls.
4. Provide touch-up as needed upon completion of remaining finishes (casework, carpentry, fixtures, etc.).
5. Provide and install filler at nail holes of installed window trims on interior finished doors if required.
6. Provide finishing of all wood trim and millwork not furnished pre-finished.
7. Protect all surfaces not requiring painting.
8. Review mechanical and electrical drawings for items requiring painting.
9. Include all sandblasting and preparation of existing steel as necessary.

BID CATEGORY #14

KITCHEN EQUIPMENT

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements

Division 01 General Requirements

11400 Kitchen Equipment

Bid Category Notes (Including, but not limited to):

1. Provide full installation of specified kitchen equipment.
2. Verify electrical, mechanical and plumbing components for connections.
3. Provide warranty information and at least a 3-year maintenance program with costs.
4. All unloading by this contractor.

BID CATEGORY #15

FIRE SUPPRESSION

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements
Division 01 General Requirements

260500 Fire Protection Requirements
210510 Fire Protection Testing, Cleaning, Water Treatment, and Start-up
211000 Fire Protection Piping

Bid Category Notes (Including, but not limited to):

1. Provide fire suppression system complete.
2. Furnish and install all sleeves in walls, floors, roofs and ceilings that may be required for this Bid Category.
3. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval of this facility.
4. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
5. Coordinate delivery and storage of material with the Construction Manager prior to delivery.
6. Provide and install pipe identification and other required identification or signage related to this Bid Category.
7. **This Bid Category is also responsible for Fire Protection Requirements as shown on the Architectural, Mechanical, and Electrical Drawings.**
8. The Mechanical, Fire Suppression, and Electrical Contractors will be required to coordinate with each other to accomplish final layout. Any relocation required to coordinate work will be done at no additional cost to the owner. All contractors are required to furnish layout and coordination prints for their work prior to installation.
9. Furnish access panels that may be required but are not shown. To be installed by others.
10. Provide a copy of all mechanical permits to the CM as soon as applied for and received.
11. Provide all dewatering of ground water and rainwater as necessary to perform the work of this Bid Category. This contractor is required to install underground in the building and out 5' from face of building and make final connection.
12. After placement of underground piping, grade is to be returned to the same condition as when the underground installation began - including compaction.

BID CATEGORY #16

MECHANICAL

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
07840	Firestopping
220500	Plumbing Requirements
220510	Plumbing Systems Testing, Cleaning, Water Treatment and Start-up
220553	Plumbing System Identification
220600	Plumbing Specialties
220700	Plumbing Pipe Insulation
221999	Plumbing Piping
230500	HVAC Requirements
230548	Vibration Isolation
230553	HVAC Identification
230593	Testing, Adjusting and Balancing
230713	External Duct Insulation
230900	Temperature Control System
233000	Air Distribution
237400	Rooftop HVAC Unit

Bid Category Notes (Including, but not limited to):

1. Provide all mechanical demolition as show or called for on plans. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
2. Furnish and install all sleeves in walls, floors, roofs and ceilings that may be required for this Bid Category.
3. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval for the facility.
4. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
5. Coordinate delivery and storage of material with the Construction Manager prior to delivery. Remove all cardboard from site and recycle or discard.
6. Open ductwork and piping shall have ends sealed during construction to reduce amount of dust and dirt within.
7. Furnish and install caulking and sealers around the plumbing fixtures and pipe.

8. Furnish templates for cutting of counter tops (by others) to the Construction Manager.
9. Provide and install pipe identification and other required identification or signage related to this Bid Category.
- 10. This Bid Category is also responsible for Mechanical Requirements as shown on the Architectural and Electrical Drawings.**
11. Furnish and install all louvers related to this bid category as shown or specified.
12. Furnish access panels that may be required but are not shown. To be installed by others.
13. Provide a copy of all mechanical permits to the CM as soon as applied for and received.
14. Provide and install all gas piping interior / exterior from meter.
15. Include any existing gas piping demo.
16. Include building temp controls.
17. Provide all plumbing demolition as show or called for on plans. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
18. Furnish and install all sleeves in walls, floors, roofs and ceilings that may be required for this Bid Category.
19. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval for the facility.
20. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.
21. Furnish and install roof drains and overflow drains, including clamping devices.
22. Furnish and install all interior floor drains, floor sinks, trench drains, cleanouts, etc. as shown on drawings.
23. Provide cleaning and testing of all piping systems for the work within this category.
24. Provide a copy of all plumbing permits to the CM as soon as applied for and received.
25. Provide final mechanical hook up of all kitchen equipment.
26. Dock pit pump is called out on the civil drawings.

BID CATEGORY #17

ELECTRICAL

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00	Project Bidding Requirements
Division 01	General Requirements
07840	Firestopping
260000	Basic Electrical Requirements
260500	Common Work Results for Electrical
260505	Selective Demolition for Electrical
260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533.13	Conduit for Electrical Systems
260533.16	Boxes for Electrical Systems
260583	Wiring Connections
260923	Lighting Control Devices
262100	Low Voltage Electrical Service Entrance
262416	Panelboards
262726	Wiring Devices
262816	Enclosed Switches and Circuit Breakers
263200	Packaged Generator Assembly
264313	Surge Protect Devices Low Voltage Elec Power Circuits
264523	Electromelt Snowmelt System
265100	Interior Lighting
265600	Exterior Lighting

Bid Category Notes (Including, but not limited to):

1. Provide all demolition of electrical items as shown or specified. Contractor shall consult with CM for equipment/materials to be turned over to owner. Provide dumpster as required for demo items.
2. Provide and install temporary lighting as required by MIOSHA and as needed to ensure sufficient lighting for construction. **Temporary lighting shall be switched and must be instant on/off type.** Metal Halide and similar lights which require long startup will not be allowed. R.C. Hendrick will determine if lighting is enough for construction.
3. Furnish drawings showing size and location of concrete pads required for electrical equipment to Construction Manager. Installation of these pads will be by others.
4. This contractor shall be responsible for all fire wall penetrations required for this work and proper sealing of the same.

5. **This Bid Category is also responsible for Electrical Requirements as shown on the Architectural, Civil and Mechanical Drawings. Review all drawings prior to bidding.**
6. Coordinate delivery and storage of material with the Construction Manager **prior** to delivery.
7. Pay for all permits, fees, inspections and approvals required by governing jurisdictions. This will include coordination between state and local agencies to ensure code compliance and for securing approval of the facility.
8. Include all cutting and coring of walls, floors ceilings, etc. as required for the installation of this work.
9. Provide a complete electrical system including, but not limited to; all wiring, panelboards, fixtures, fire alarm systems, lighting controls, sound systems, etc.
10. Provide Network / Communication raceways if shown or specified.
11. Furnish access panels required for all electrical items, which require access in inaccessible areas. Access panels to be installed by others.
12. Final cleaning of fixtures and equipment is by others. This contractor to protect fixtures from damage during storage.
13. All inspection reports from local, state and federal inspection agencies will be provided to the Construction Manager.
14. Include all connections of power wiring to devices, including equipment, motors, heaters, automatic door openers and strikes (review Architectural and Mechanical Drawings for items not shown on Electrical Drawings).
15. Duct smoke detectors shall be provided and installed by this Bid Category.
16. Provide and install electromagnetic hold opens (complete) at required door openings. Final power connection is by this subcontractor.
17. Provide and install all low voltage raceways, and power for temperature controls if shown or specified.
18. Provide and install all motor starters, disconnects, etc. as shown or specified.
19. Provide electrician on site upon startup of mechanical units to verify proper rotation and power.
20. Provide and install emergency generator as shown or called for.
21. Provide all final electrical hook up to kitchen equipment.

BID CATEGORY #18

FENCING

The work scope for this Bid Category includes, but is not limited to the work as specified in the R.C. Hendrick Project Manual, the Architect's Technical Specification, the Drawings and any Addenda issued prior to the bid date.

Provide all labor, materials and equipment to satisfy the following Specification Sections and Notes unless otherwise noted.

Division 00 Project Bidding Requirements

Division 01 General Requirements

28020 Fences and Gates (Site Fencing)

Bid Category Notes (Including, but not limited to):

1. Furnish and install all Site Fencing Work on the project.

END OF SECTION 00 2400

SECTION 00 3100

INFORMATION AVAILABLE TO BIDDERS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SOIL EVALUATION - Was NOT performed on this project.

- 1.2.2 This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the designers.
- 1.2.3 The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.
- 1.2.4 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 additions or deductions to the Contract Sum accruing to the Owner.

END OF SECTION 00 3100

SECTION 00 3113

MILESTONE SCHEDULE

All bid categories shall participate in coordinating the construction schedule with both the Construction Manager and other trade contractors to meet the Milestone Dates indicated in the bidding documents. The dates either listed below or on the attached schedule are not intended to be a complete breakdown of the work; rather it is a list of milestone dates that must be met by all trade contractors to ensure the project is completed on time. Trade contractors shall include all costs they feel are necessary to complete the work by these milestone dates and include all overtime and shift work even if not called for in the scope description. All trade contractors shall endeavor to improve upon the milestone dates if possible.

If a bidder feels that the dates given are unreasonable or they are impossible to meet, they are to notify R.C. Hendrick by email prior to the bid date. R.C. Hendrick will review the request and, if necessary, issue an addendum modifying the Milestone Schedule. If no objections are heard, it will be understood that the Milestone Schedule can be met by all trade contractors.

Meeting the schedule is an imperative part of the project to all parties, therefore R.C. Hendrick reserves the right to take or recommend the following action(s) if the milestone dates are in danger of, or not, being met.

1. R.C. Hendrick will request a written recovery schedule from the trade contractor(s).
2. The trade contractor(s) will be directed to increase crew size or add equipment on site.
3. The trade contractor(s) will be directed to add a second shift or work overtime.
4. If the above measures do not fulfill the requirements of the Milestone Schedule, the trade contractor(s) may be supplemented with additional personnel or equipment by others, or any necessary action required.

All costs associated with the above measures will be the responsibility of the trade contractor(s) involved, to the extent that it was delayed by others. If a trade contractor is found to have delayed the work, they will be responsible for any additional costs necessary to get the project back on schedule.

Milestone Schedule: As soon as possible. Bidders should be aware that Hidden Harvest must have access to their food storage areas on the south side of the building throughout construction. This means that until the new access to the storage is ready, construction of the storage area and parking garage cannot begin.

END OF SECTION 00 3113

SECTION 00 3146

PERMITS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 PERMITS AND FEES

- 1.2.1 The Owner, through the Construction Manager shall pay for and furnish the general Building Permit.
- 1.2.2 Other than the Building Permit, each Trade Contractor is required to secure and pay for all permits and fees necessary for your scope of work.
- 1.2.3 The Construction Manager shall schedule the General Building Inspection. Trade Contractors will be notified verbally or in writing of the date of inspection(s).
- 1.2.4 It is the responsibility of each Trade Contractor to schedule appropriate inspections of the work by the authorized inspector of the permit you secured. The Construction Manager is to be notified immediately of any scheduled inspection(s).
- 1.2.5 This project is under the following jurisdictions:

Building	City of Saginaw
Life Safety	Local Fire Marshall
Mechanical	City of Saginaw
Plumbing	City of Saginaw
Electrical	City of Saginaw
Elevator	City of Saginaw
Right of Way	Local Authority
Demolition	City of Saginaw

END OF SECTION 00 3146

SECTION 00 4000

BID FORM

TO: Earl Soules - PM / OR Hunger Solutions Expansion Project
Hunger Solution Center
940 E. Genesee Ave.
Saginaw, MI 48607

RE: Hunger Solution Center
Additions & Renovations

Having carefully reviewed the bidding documents described in Section 00 1000 and understanding the scope of work involved in the proposed Bid Category and those that interface with it, we hereby propose to furnish labor, materials, tools, equipment, supervision, insurance and services required for the completion of all work required for the Bid Category indicated in accordance with the Bid Category Description and the Contract Documents prepared by the Architect and Construction Manager.

BID CATEGORY #: _____ **DESCRIPTION:** _____

BIDDERS NAME: _____

BASE BID:

Total Base Sum of _____

_____ Dollars \$ _____

(OPTIONAL) COMBINED BID FOR CATEGORIES: _____ :

Total Combined Sum of _____

_____ Dollars \$ _____

ADDENDA:

And having received and examined the following Addenda: (include date for acknowledgement)

Addendum Number _____ , dated _____ , 2025
Addendum Number _____ , dated _____ , 2025
Addendum Number _____ , dated _____ , 2025
Addendum Number _____ , dated _____ , 2025
Addendum Number _____ , dated _____ , 2025

ALTERNATES:

Bidders shall indicate on the Bid Form if the Alternate is an ADD or DEDUCT to the Base Bid and indicate the costs associated. If the Alternate does not affect your base bid you must circle NO CHANGE.

ALTERNATE 1: DELETE ALL WORK RELATED TO THE VEHICLE STORAGE ADDITION (5,469 SQ. FT.) AND THAT AREA WILL BECOME A GREEN SPACE.

ADD \$ _____ DEDUCT \$ _____ NO CHANGE

ALTERNATE 2: ADD AMOUNT FOR P, L, M BONDS.

ADD \$ _____

VOLUNTARY ALTERNATES / SUBSTITUTIONS:

Bidder is cautioned to bid on the "Standards" specified. The following substitutions from the "Standards" specified are listed herein for consideration, and if accepted, the contract sum may be adjusted in accordance with the following:

_____ Add / Deduct \$ _____

_____ Add / Deduct \$ _____

EXPERIENCE MODIFICATION RATE (EMR):

List the EMR for your firm as described by your insurance carrier for the past three (3) years.

2024 _____ 2023 _____ 2022 _____

TIME AND MATERIAL RATES: (REQUIRED)

Labor rates listed below include the following: Cost of labor including Michigan Single Business Tax, Social Security and Medicare, Federal and State Unemployment tax, and Fringe Benefits Under Collective Bargaining Agreements, and Worker's Compensation Insurance. The rates listed below do not include overhead and/or profit. These rates are only for additions and/or deletions to the contract that could not have been anticipated at the time of the bid.

Trade	Straight Time	Shift Time	1 ½ Time	Double Time

WORK TIME:

The undersigned hereby agrees to complete the entire work per the Milestone Schedule.

CONTRACT:

The undersigned agrees that the above Base Bid Prices shall hold for 90 days and Alternate Prices for 120 days after receipt of proposals, to accept provisions of "Instructions to Bidders."

SUBMITTED BY:

Firm Name: _____

Address: _____

City/St/Zip: _____

Email Address: _____

Signed: _____ Title: _____

Typed Name: _____ Date: _____

Phone: _____ Fax: _____

If Bidder is a Corporation, indicate State of Incorporation: _____

If a Partnership, give full names of all Partners: _____

END OF SECTION 00 4000

SECTION 00 5000

CONTRACT / AGREEMENT FORM

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 CONTRACT / AGREEMENT FORM

- 1.2.1 Contracts will be direct between the Owner and the Trade Contractor.
- 1.2.2 The form of agreement will be the Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition, AIA Document A132-2009.
- 1.2.3 A sample copy of the agreement form can be viewed or downloaded at:
www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

END OF SECTION 00 5000

SECTION 00 7200

GENERAL CONDITIONS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 GENERAL CONDITIONS

- 1.2.1 The General Conditions which shall become a part of the agreement will be the General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, AIA Document A232-2009.
- 1.2.2 A sample copy of the General Conditions can be viewed or downloaded at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."

END OF SECTION 00 7200

SECTION 00 7300

SUPPLEMENTARY CONDITIONS

GENERAL CONDITIONS

1. The General Conditions of this contract are the American Institute of Architects Standard Document A232-2009, titled "General Conditions of the Contract for Construction, Construction Manager as Adviser Edition." This document is hereby made part of the Contract Documents.
2. The following supplements modify AIA Document A232-2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

ARTICLE 2 - OWNER

1. Delete subparagraph 2.2.5 and substitute:
2.2.5 - The Contractor will be furnished, subject to a deposit, all copies of drawings and specifications reasonably necessary for execution of the work as determined by the Construction Manager.

ARTICLE 3 - CONTRACTOR

1. Add Section 3.4.2.1 to Section 3.4.2:
3.4.2.1 After the Contract has been executed, the Owner, Construction Manager and Architect will consider requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).
By making requests for substitutions, the Contractor:
 - .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
 - .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
 - .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and
 - .4 shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.
2. Delete subparagraph 3.4.3 and substitute:
3.4.3 The Contractor shall at all times enforce strict discipline and good order among the Contractor's employees and any subcontractor employed by the contractor and shall not employ on the work any unfit person or anyone not skilled in the task assigned to them.

3. Add subparagraph 3.7.6
3.7.6 Regarding OSHA fines: The Contractor for any fines incurred as a result of the Contractor shall reimburse the Construction Manager for similar fines against the Construction Manager.
4. Add subparagraph 3.9.4
3.9.4 The Construction Manager reserves the right to cause the replacement of the superintendent, assistant superintendent or employee of the contractor who is not qualified, in the opinion of the Construction Manager to do the work.

ARTICLE 5 - SUBCONTRACTORS

1. RE: Subparagraphs 5.2.1, 5.2.2, 5.2.3, and 5.2.4.
Delete the words, "the Construction Manager or Architect" and insert the words, "the Construction Manager and Architect."

ARTICLE 7 - CHANGES IN THE WORK

1. Add Subparagraph 7.1.4
7.1.4 The maximum allowable markup on Changes in the Work shall be ten percent (10%) which includes overhead, profit, estimating expenses, other office expense, bond and insurance costs."
2. RE: Subparagraph 7.3.7
Delete the words, "the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount." and insert the words, "Section 7.1.4."

ARTICLE 8 - TIME

1. Add subparagraph 8.3.4
8.3.4 Claims for Delay: In the event the contractor is delayed in completing the work by the Owner for any reason, whether intentional or otherwise, and the delay does not preclude the contractor from completing the work within the time period specified in the contract agreement, the contractor shall be entitled to no remedy for such delay.

ARTICLE 9 - PAYMENTS AND COMPLETION

1. Add subparagraph 9.3.1.3
9.3.1.3 Up to time the work is substantially complete, the owner will make monthly payments to the contractor, based on the schedule of values of 90% of the value of labor and materials incorporated in the work and of 90% of all tangible materials stored at the site during that month. The Owner will have retained five percent (5%) of the total contract price for "Closeout Materials" and five (5%) of the total contract price for "Punch List Completion". The Contractor may request payment of the retained percentages upon completion of that portion of their Work.

2. Add subparagraph 9.3.1.4
9.3.1.4 Deliver estimates to the Construction Manager for approval as agreed upon. The form of application for payment shall be AIA Document G732-2009, notarized by Contractor and supported by AIA Document G703 – Continuation Sheet.
3. Add clause .8 to subparagraph 9.5.1
.8 Unsatisfactory clean-up in accordance with subparagraph 3.15.

ARTICLE 11 - INSURANCE AND BONDS

1. Add the following Sections 11.1.2.1 through 11.1.2.4 to Section 11.1.2:
11.1.2.1 The limits for Worker's Compensation and Employers' Liability insurance shall meet statutory limits mandated by State and Federal laws. If (1) limits in excess of those required by statute are to be provided, (2) the employer is not statutorily bound to obtain such insurance coverage, or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY INSURANCE:

Worker's Compensation:	State of Michigan Statutory Limits
Employer's Liability:	\$500,000 - each accident \$500,000 - disease (each employee) \$500,000 - disease (policy limit)

11.1.2.2 The limits for Commercial General Liability insurance including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse, and Underground Hazards) shall be as follows:

COMMERCIAL GENERAL LIABILITY INSURANCE:

Bodily Injury	\$1,000,000 - each occurrence \$2,000,000 - aggregate
Property Damage	\$1,000,000 - each occurrence \$2,000,000 - aggregate
Fire Damage (any one fire)	\$100,000
Medical Expense (any one person)	\$5,000

Notes:

- (1) Products-Completed Operations Insurance shall be maintained for a minimum period of one (1) year after final payment.
- (2) The Owner, Architect and Construction Manager shall be listed as additional insured. The Owner shall be the certificate holder.

11.1.2.3 Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage:

AUTOMOBILE LIABILITY INSURANCE:

Bodily Injury	\$1,000,000
Property Damage	\$1,000,000

11.1.2.4 Umbrella or Excess Liability Coverage:

UMBRELLA / EXCESS LIABILITY INSURANCE:

Umbrella / Excess Insurance	\$2,000,000 - each occurrence
	\$2,000,000 - aggregate

2. Add Subparagraph 11.3.11

11.3.11 The provisions of this paragraph 11.3 shall not operate to relieve the Contractor of responsibility for loss or damage to the Contractor's own or rented property or property of Contractor's employees of whatever kind or nature, including but not limited to: tools, equipment, forms, scaffolding and temporary structures, including their contents. The Owner shall in no event be liable for loss or damage to the aforementioned items or other property of the contractor that is not included in the permanent construction.

3. Delete Subparagraph 11.3.7 Waivers of Subrogation

ARTICLE 13 - MISCELLANEOUS PROVISIONS

1. Delete subparagraph 13.6 - Interest in its entirety.

END OF SECTION 00 7300

SECTION 00 7316

INSURANCE REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 INSURANCE REQUIREMENTS

- 1.2.1 Each contractor shall provide, to the Owner, through the Construction Manager, a certificate of insurance indicating that all required insurance coverage is in effect. This certificate shall be provided before any Work begins.
- 1.2.2 Limits of required insurance are listed in the Supplementary Conditions, Section 00 7300 – Article 11. Contractors are to provide at least the limits stated in that section.
- 1.2.3 The Owner, Architect, and Construction Manager shall be listed as “additional insured” on the insurance certificate.
- 1.2.4 A sample Acord Insurance Certificate with instructions is attached for your use.

1.3 INSURANCE FOR STORED MATERIAL

- 1.3.1 If a Contractor wishes to be paid for stored material that is not presently on the jobsite, they will be required to furnish photographic evidence of the material as well as an insurance certificate for the material.

1.4 BUILDER’S RISK INSURANCE

- 1.4.1 Per the General Conditions, the Owner shall secure and pay for Builder’s Risk Insurance for the Project.

END OF SECTION 00 7316

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 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 The name and address of the Insurance Company goes here	CONTACT NAME: PHONE (A/C, No, Ext): E-MAIL ADDRESS: PRODUCER CUSTOMER ID #: INSURER(S) AFFORDING COVERAGE NAIC #
INSURED The name and address of the Prime Contractor goes here	INSURER A : INSURER B : INSURER C : INSURER D : INSURER E : INSURER F : The name(s) of the insurance companies providing coverage

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 INSR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	GENERAL LIABILITY ☒ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☒ OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐ PRO-JECT ☐ LOC		Policy Number Must Be Listed Here	Start/End dates of Policy must be listed here		EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000 MED EXP (Any one person) \$ 5,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000
	AUTOMOBILE LIABILITY ☒ ANY AUTO ☒ ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☒ HIRED AUTOS ☐ NON-OWNED AUTOS		Policy Number Must Be Listed Here	Start/End dates of Policy must be listed here		COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$ \$
	☒ UMBRELLA LIAB ☐ OCCUR ☐ EXCESS LIAB ☐ CLAIMS-MADE DEDUCTIBLE \$ RETENTION \$		Policy Number Must Be Listed Here	Start/End dates of Policy must be listed here		EACH OCCURRENCE \$ 2,000,000 AGGREGATE \$ 2,000,000 \$ \$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) ☐ Y / N If yes, describe under DESCRIPTION OF OPERATIONS below	N/A	Policy Number Must Be Listed Here	Start/End dates of Policy must be listed here		☒ WC STATUTORY LIMITS ☐ OTHER E.L. EACH ACCIDENT \$ 500,000 E.L. DISEASE - EA EMPLOYEE \$ 500,000 E.L. DISEASE - POLICY LIMIT \$ 500,000

This section does not need to be filled out unless a specific coverage is required

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

List the Owner, Architect and Construction Manager as Additional Insured

CERTIFICATE HOLDER

The Owner shall be listed here as the Certificate Holder

CANCELLATION

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

Signature of your authorized insurance agent

SECTION 00 8100

SAFETY REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SAFETY NARRATIVE

- 1.2.1 Safety does not start in the field; it takes planning and forethought before field operations even begin. Contractors will require a clear vision of what work activities their respective companies will perform and how to provide a safe work environment for all persons on the site. Each contractor should do a Job Hazard Analysis to determine the safety requirements for their job functions before finalizing their bid. R.C. Hendrick & Son is aware that the success of a safety and health program is contingent and dependent on support and involvement from all employees of the company and all trade contractors. For any construction project to be considered a success, it must be a safe project. Any unsafe acts shall be dealt with and corrected immediately.

R.C. Hendrick reserves the right to remove any worker from the site for improper conduct, poor attitude toward safety or not following requirements in this section.

All personnel on site should be looking out for the safety of anyone on site. If you suspect a worker is engaging in a potentially unsafe activity, all workers have the right to ask the individual if the activity meets their company safety plan or MIOSHA standards and should notify R.C. Hendrick for further action.

1.3 SAFETY REQUIREMENTS

- 1.3.1 Before commencing any work, trade contractors are required to provide a copy of their Accident Prevention Plan (Safety Plan), Respirable Silica Program (if it pertains to your work scope), and the Safety Data Sheets (SDS Documents) for all hazardous materials they will be using on site.
- 1.3.2 All Trade Contractors are required to understand and comply with OSHA, MIOSHA as well as any other agency that has jurisdiction over the Project. **In addition, each Trade Contractor shall be responsible for payment of all fines and/or claims levied against the Owner, Architect or CM/Constructor for deficiencies relating to the Work or Conduct of a Trade Contractor.**
- 1.3.3 Trade Contractors shall also be required to comply with the R.C. Hendrick Company Safety Manual. A copy of the safety manual is available for review at:

www.rchendrick.com. Click on “Plan Room” and then click on the link “Specification Forms.”

- 1.3.4 R.C. Hendrick will also create a Site-Specific Safety Manual that is specifically tailored to the Project. Topics in the manual may include Site-Specific Safety Hazards, Emergency Procedures, Nearest Emergency Center, and Important Contact Information. This manual will be completed prior to the start of construction and will be posted at the jobsite and can be made available electronically if requested.
- 1.3.5 Operate machinery and equipment only if properly trained, qualified and authorized to do so.
- 1.3.6 Provide a completed daily inspection report for all rough terrain vehicles, scissor lifts and aerial lifts turned in to the R.C. Hendrick Superintendent.
- 1.3.7 Wear the required personal protective equipment (PPE) for the duties performed.
 - 1.3.7.1 Hard Hat, Safety Glasses, Construction Level Work Boots, High-Visibility Clothing (Outer Layer)
- 1.3.8 Keep work areas safe by exhibiting good housekeeping skills.
- 1.3.9 Report all unsafe work conditions immediately to your foreman, safety representative or the R.C. Hendrick Superintendent.
- 1.3.10 Before starting a work activity, make sure you are ready to perform your job tasks safely, no “short-cuts.” Use the right tool for the task.
- 1.3.11 Do not undertake any activities that would put yourself or anyone else in harm or danger.
- 1.3.12 If a tool or piece of equipment is malfunctioning or shows a defect, remove it from service immediately.
- 1.3.13 Report any injury, illness, property/equipment damage, or near-misses immediately to your foreman, supervisor, or R.C. Hendrick Superintendent.
- 1.3.14 The use of tobacco products, drugs or alcohol is strictly prohibited.
- 1.3.15 Weekly “tool-box-talks” are required and a signed copy should be turned into the R.C. Hendrick Superintendent.
- 1.3.16 R.C. Hendrick’s safety officer or regulatory agencies may periodically inspect the jobsite for safety violations and will report the findings to the project superintendent.

END OF SECTION 00 8100

SECTION 01 1100

SUMMARY

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes the following:

- A. Work covered by the Contract Documents.
- B. Type of the Contract.
- C. Owner-furnished products.
- D. Use of premises.
- E. Owner's occupancy requirements.
- F. Work restrictions.
- G. Specification formats and conventions.

- 1.2.2 Related Sections include the following:

1.3 TYPE OF CONTRACT

- 1.3.1 Project will be constructed under multiple prime contracts direct with the Owner.

1.4 OWNER-FURNISHED PRODUCTS

- 1.4.1 Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment.

1.5 USE OF PREMISES

- 1.5.1 General: Each Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- 1.5.2 Use of Site: Limit use of premises to areas as directed by Construction Manager. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - A. Owner Occupancy: Allow for Owner occupancy of Project site
 - B. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1. Schedule deliveries to minimize use of driveways and entrances.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.5.3 Use of Existing Building: Maintain existing building in a weather-tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.6 OWNER'S OCCUPANCY REQUIREMENTS

1.6.1 Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

- A. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
- B. Provide not less than five (5) calendar days' notice to Owner of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

1.7.1 Existing Utility Interruptions: 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:

- A. Notify **Owner** not less than ten days in advance of proposed utility interruptions.
- B. Do not proceed with utility interruptions without **Owner's** written permission.

1.8 SPECIFICATION FORMATS AND CONVENTIONS

1.8.1 Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "Master Format" numbering system.

- A. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
- B. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

1.8.2 Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

- A. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
- B. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - 1. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. PRODUCTS (Not Used)

3. EXECUTION (Not Used)

END OF SECTION 01 1100

SECTION 01 2100

ALLOWANCES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements governing allowances.

- A. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

- 1.2.2 Types of allowances include the following:

- A. Lump-sum allowances.
 - B. Contingency allowances.
 - C. Testing and inspecting allowances.

- 1.2.3 Related Sections include, but not limited to the following:

- A. Division 01 2600 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for changes.
 - B. Division 01 4000 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
 - C. Divisions 02 0000 Sections through 33 0000 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

- 1.3.1 At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- 1.3.2 At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- 1.3.3 Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

- 1.4.1 Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
- 1.4.2 Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- 1.4.3 Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

- 1.5.1 Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM ALLOWANCES

- 1.6.1 Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
- 1.6.2 Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 CONTINGENCY ALLOWANCES

- 1.7.1 Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- 1.7.2 Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- 1.7.3 Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- 1.7.4 At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 TESTING AND INSPECTING ALLOWANCES

- 1.8.1 Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

- 1.8.2 The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- 1.8.3 Costs of services not required by the Contract Documents are not included in the allowance.
- 1.8.4 At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 UNUSED MATERIALS

- 1.9.1 Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - A. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

PART 3 EXECUTION

3.1 EXAMINATION

- 3.1.1 Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- 3.2.1 Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- 3.3.1 Refer to Bid Category Notes for allowances to be included in your Bid.

END OF SECTION 01 2100

SECTION 01 2200

UNIT PRICES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITION

- A. A Unit price is stated on the Bid Form as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 UNIT PRICES

- A. Unit prices include all necessary material plus cost for delivery, installation, insurance, applicable taxes, overhead and profit.
- B. Refer to individual specification sections for work that requires establishment of Unit Prices. Methods of measurement and payment are specified in those sections.
- C. The Owner or Construction Manager reserve the right to reject contractor's measurement of work-in-place that involves the use of established unit prices and to have this work measured, at the Owner's expense, by an independent firm acceptable to contractor.
- D. Additional Unit Prices may be required following the submission of bids.

PART 3 EXECUTION

3.1 SCHEDULE OF UNIT PRICES

See Section 01 2200 - Unit Prices issued by the Architect.

END OF SECTION 01 2200

SECTION 01 2300

ALTERNATES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements for alternates as proposed by the Architect.

- A. **Voluntary Alternates or Substitutions proposed by Bidders will not form the Base Bid Proposal Price.**

1.3 DEFINITIONS

- 1.3.1 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 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.

- A. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

- 1.3.2 Voluntary Alternates: Bidders proposed voluntary alternates and substitutions will not be recognized as part of the Base Bid Price opening. Owner may review voluntary proposals with the successful Bidder.

1.4 PROCEDURES

- 1.4.1 Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

- A. 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.

- 1.4.2 Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- 1.4.3 Execute accepted alternates under the same conditions as other work of the Contract.
- 1.4.4 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.

3. EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate #1: Delete all work related to the vehicle storage addition (5,469 sq. ft.) and that area will become a green space.

Alternate #2: Add amount for P, L, M bonds.

END OF SECTION 01 2300

SECTION 01 2600

CONTRACT MODIFICATION PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This section specifies administrative and procedural requirements for handling and processing contract modifications.

- 1.2.2 Related Sections

- A. Section 013300 – “Submittal Procedures”
 - B. Section 010270 – “Application for Payment”

1.3 MINOR CHANGES IN THE WORK

- 1.3.1 Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Construction Manager on AIA form G10/CMA.

1.4 CHANGE ORDER PROPOSAL REQUESTS

- 1.4.1 Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Construction Manager, with a detailed description of the proposed change and supplemental or revised drawings and specifications, if necessary.
 - A. These requests will be identified as “BULLETINS.”
 - B. Bulletins issued by the Architect are for information only. Do not consider them as instructions whether to stop work in progress, or to execute the proposed change.
 - C. Unless otherwise indicated in the bulletin, submit to the Construction Manager for Architect and Owner review, the cost necessary to execute the proposed changes. In the proposal:
 - 1. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - 2. Indicate applicable taxes, delivery charges, equipment rental, and amount of trade discounts.

3. Include a statement indicating the effect of the proposed change on the Contract Time.
4. Indicate Overhead and Profit amounts.

1.4.2 Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the contract, the Contractor may propose changes by submitting a request to the Construction Manager for a change.

- A. Include a statement outlining the 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 Contract Time.
- B. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
- C. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- D. Comply with requirements in Section 001000 Part 6.2 "Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

1.4.3 Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.5 CONSTRUCTION CHANGE DIRECTIVE

1.5.1 When the Owner and Contractor are not in total agreement on the terms of a Change Order Request, the CM may issue a Construction Change Directive (CCD) on AIA Form G714 instructing the Contractor to proceed with a change in the Work for subsequent inclusion in a Change Order.

- A. The CCD will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

1.5.2 Documentation: Maintain detailed records on a time and material basis of work required by the CCD.

- A. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES

1.6.1 Upon the Owner's approval of a Change Order Proposal Request, the Construction Manager will issue a Change Order for signatures of the Owner, Architect, CM, and Contractor on AIA Form G732, as provided in the conditions of the Contract.

2. PRODUCTS (Not Applicable)
3. EXECUTION (Not Applicable)

END OF SECTION 01 2600

SECTION 01 2900

PAYMENT APPLICATION PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION

- 1.2.1 Work included: Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.
- 1.2.2 Related Work
 - A. The Contract Sum and the schedule for payments are described in the form of agreement.
 - B. Payments upon Substantial Completion and Completion of the Work are described in the General Conditions and in Section 017000 of these Specifications.

1.3 QUALITY ASSURANCE

- 1.3.1 Prior to start of construction, secure the Construction Manager and Architect/Engineer's approval of the Schedule of Values required to be submitted under Paragraph 9.2 of the General Conditions.
- 1.3.2 During progress of the Work, modify the Schedule of Values as approved by the Construction Manager and Architect/Engineer to reflect changes in the Contract Sum due to Change Orders or other modifications of the Contract.
- 1.3.3 Base requests for payment on the approved Schedule of Values.

1.4 SUBMITTALS

- 1.4.1 Formal submittal unless otherwise directed by the Construction Manager:
 - A. Make formal submittal of request for payment by filling in the agreed data, by typing, on AIA Document G703, "Application and Certificate for Payment, Construction Manager-Advisor Edition," plus Continuation Sheet(s) G703.
 - B. Sign and notarize the Application and Certificate for Payment.
 - C. Submit the original of the Application and Certificate for Payment, plus two identical copies to the Construction Manager. The Application is to be made out to the Owner and mailed/delivered to the Construction Manager.

- D. The CM will review the formal submittal, and when approved, will sign the Application and Certificate for Payment, will forward to the Architect for signature, and will distribute one fully executed copy to:
 - 1. Contractor
 - 2. Owner
 - 3. Construction Manager File
- E. The Owner will, upon approval of the Architect/Engineer, disburse directly to the Contractor in accordance with Article 9 of the agreement between Owner and Contractor.

2. PRODUCTS (Not Applicable)

3. EXECUTION (Not Applicable)

END OF SECTION 01 2900

SECTION 01 2976

SWORN STATEMENTS AND WAIVERS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements for sworn statements, partial waivers and full waivers.
- 1.2.2 Sample Sworn Statement and Waivers can be viewed or downloaded at: www.rchendrick.com. Click on "Plan Room" and then click on the link "Specification Forms."
- 1.2.3 No payment will be made without the proper Sworn Statements and applicable Full or Partial Waivers.

1.3 SWORN STATEMENT

- 1.3.1 A signed and notarized Sworn Statement shall be included with each payment application.
- 1.3.2 Sworn Statement shall include all subcontractors and suppliers. List their work description, total contract amount, amounts paid, amounts owing, any retentions held and balances to complete.

1.4 PARTIAL WAIVER

- 1.4.1 Partial waivers must be provided beginning with the second application for payment. Partial waivers must be provided for every payment listed on the previous month's Sworn Statement.

1.5 FULL WAIVER

- 1.5.1 Before a Trade Contractor can receive final payment, they must submit full waivers from all subcontractors and suppliers.

END OF SECTION 01 2976

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 - A. General project coordination procedures
 - B. Administrative and supervisory personnel
 - C. Coordination Drawings
 - D. General installation provisions
 - E. Cleaning and protection
 - F. Limitations for use of the site
 - G. Coordination program
- 1.2.2 Related Section: The following Sections contain requirements that relate to this Section:
 - A. Division 01 3100 Section "Project Management and Coordination" for progress meetings, coordination and pre-installation conferences.
 - B. Division 01 6000 Section "Product Requirements" for coordinating materials and equipment for general installation.
 - C. Division 01 7300 Section "Execution Requirements" for Layout and Measurements, specifies procedures for field engineering services, including establishment of benchmarks and control points.

1.3 COORDINATION

- 1.3.1 Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend upon each other for proper installation, connection, and operation.
 - A. Schedule construction operations in the 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.
 - B. Coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - C. Make adequate provisions to accommodate items scheduled for later installation.

1.3.2 Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

A. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

1.3.3 Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

A. Preparation of schedules

B. Installation and removal of temporary facilities

C. Delivery and processing of submittals

D. Progress meetings

E. Project closeout activities

1.4 LIMITATIONS ON USE OF THE SITE

1.4.1 General: Limitations on site usage as well as specific requirements that impact site utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements administer allocation of available space equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on the site.

1.5 SUBMITTALS

1.5.1 Coordination Drawings: Prepare coordination drawings for above ceiling work, equipment rooms and other areas where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

A. Show the relationship of components on separate Shop Drawings.

B. Indicate required installation sequence.

1.5.2 Staff Names: Within fifteen (15) calendar days of "Notice to Proceed," submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities. List their addresses and telephone numbers.

A. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

1.5.3 Other Project names, addresses and information:

A. Lists of sub-contractors and erectors

B. List of suppliers and manufacturers

2. PRODUCTS (Not applicable)

3. EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

- 3.1.1 Inspection of Conditions: Require the Installer of each component to inspect both the substrate and conditions under which Work is to be performed. Proceed when unsatisfactory conditions have been corrected.
- 3.1.2 Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction.

3.2 COORDINATION PROGRAM

- 3.2.1 It shall be the responsibility of the Construction Manager/General Contractor to coordinate the equipment room requirements and the above ceiling space requirements of the various subcontractors and to determine that adequate clearance is allowed with respect to their equipment and the building.
- 3.2.2 The Coordination Program shall consist of a series of meetings with all trades involved and the preparation of installation drawings prepared from base drawings produced by the Sheet Metal Subcontractor. The Mechanical, Electrical and Fire Protection Subcontractors shall use the base drawings for producing their individual installation drawing overlays for coordination with other trades.
- 3.2.3 The following sequence shall be followed:
 - A. After the award of contract and prior to construction the Construction Manager/General Contractor will schedule a meeting to introduce the Coordination Program and determine its implication to the progress schedule. Attendees shall include the Construction Manager/General Contractor, Owner's Representative, Architect/Engineer and all subcontractors responsible for work in equipment rooms and in or above the ceilings which includes (but is not limited to) those items below:
 - 1. Recessed lighting fixtures
 - 2. Plumbing waste, vent and roof drainage
 - 3. Steam, condensate and all other pitched services
 - 4. Ductwork and appurtenances
 - 5. Fire protection (sprinkler system)
 - 6. HVAC piping
 - 7. Plumbing, supply and service piping
 - 8. Cable tray
 - 9. Electrical conduit
 - (a) The above list, in descending order, is the precedence for space priority. Recessed light fixtures and space for their installation have first priority, plumbing waste, vent and roof drainage has second priority, etc.

- B. The Construction Manager/General Contractor shall confirm that the following have been provided to the Sheet Metal Subcontractor prior to commencing the base drawings:
 - 1. Approved structural steel drawings
 - 2. Clearance requirements for plumbing, piping, etc. from the Mechanical Subcontractor
 - 3. Clearance requirements for recessed lighting, cable trays, etc. from the Electrical Subcontractor
 - 4. Clearance requirements for piping from the Fire Protection Subcontractor.
- C. The Sheet Metal Subcontractor shall prepare and provide the Mechanical, Electrical and Fire Protection Subcontractors with reproducible transparent drawings which shall serve as the base drawings. The base drawings shall show column center lines, interior partition locations, and ceiling heights.
- D. The Sheet Metal Subcontractor, with reference and consideration to the structural, mechanical, electrical, fire protection, and plumbing requirements provided and the reflected ceiling plans, shall draw, to scale (minimum ¼" scale), the proposed ductwork installation showing duct sizes, equipment layouts, and dimensions from column lines and distance from finished floors to bottom of ducts and equipment. In congested areas, the Sheet Metal Subcontractor shall, in addition, prepare drawings in Section view.
- E. The base drawings with ductwork layouts shall be produced in sequence as mandated by the project schedule. The earliest area indicated in the schedule will receive the first effort, etc.
- F. When the base drawings for the earliest scheduled area have been completed (time limitation as determined in the initial coordination meeting), the Sheet Metal Subcontractor shall provide the Construction Manager/General Contractor with one set of mylars for each participant in the effort. Upon receipt of the base drawings from the Construction Manager/General Contractor each participant shall incorporate on the drawings, their proposed installation. Each of the subcontractors proposed installation drawings shall indicate to scale, size, equipment layout, equipment clearance requirements, dimensions from column centerlines and distance from the finish floor to bottom of equipment, piping, conduits, etc. The Contract Drawings shall be followed as a general guide for the proposed installation drawings.
- G. The major components to be indicated include (but are not limited to):
 - 1. Roof drain leaders
 - 2. Waste and vent piping
 - 3. Fire protection piping
 - 4. Plumbing and lab service piping
 - 5. HVAC and Mechanical ductwork routing
 - 6. Electrical conduit and Cable tray runs
 - 7. Contract ceiling heights and Soffit locations
 - 8. Access points for access to valves and Dampers
 - 9. Firewall penetrations
- H. Prior to fabrication of ductwork and within a period of not to exceed two (2) calendar weeks after distribution of the mylars to the individual participants, the Construction Manager/General Contractor will schedule a meeting with the

Owner's Representative, the Architect/Engineers and participating Subcontractors at which time areas of conflict shall be resolved through the following process:

1. The transparent tracings shall be overlaid on a light table to identify areas of conflict. All parties shall then cooperate in resolving the conflicts.
2. The Owner's Representative and the Architect/Engineer reserve the right to determine space priority of the Subcontractors in the event of interference between piping, conduits, ducts and equipment of the various Subcontractors.
3. Records of the areas of conflict and the names of the subcontractor who is to make modifications to their drawings shall be kept by the Construction Manager/General Contractor. This record shall be updated on a weekly basis and shall be incorporated into the coordination meeting minutes.
4. Once all areas of conflict are resolved, each participant shall revise their drawings and shall submit for review. After review, ductwork can be fabricated, and installation of work can begin. A permanent record of the agreement shall be entered on each Subcontractors' installation drawings, acknowledged by all participants by signature in a space provided for this purpose. The Construction Manager/General Contractor shall provide and distribute two graphic copies of each subcontractor's signed installation drawings to all parties involved. Revisions to drawings as a result of the coordination process shall not be considered an extra and will not result in a change to the contract.
5. The above drawings, review and coordination process will be repeated until all areas on the Project have been coordinated.
- I. Shop drawings shall be modified through the coordination process to reflect the final resolved locations of equipment prior to submittal for review.
- J. In the event a Subcontractor fails to cooperate in the Coordination Program, he shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Subcontractor's installations.
- K. When a Change Order request is issued, the affected Subcontractors shall review the Coordination Drawings and bring to the attention of the Construction Manager/General Contractor any revisions necessary to the work of others affected by the Change Order.

3.2.4 At the completion of the project, each subcontractor shall provide the Construction Manager/General Contractor with a reproducible transparent drawing of the installation drawings to be forwarded to the Owner.

3.3 CLEANING AND PROTECTION

3.3.1 Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

- 3.3.2 Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- 3.3.3 Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
- A. Excessive static or dynamic loading.
 - B. Excessive internal or external pressures.
 - C. Excessively high or low temperatures.
 - D. Thermal shock.
 - E. Excessively high or low humidity.
 - F. Air contamination or pollution.
 - G. Water or ice.
 - H. Solvents.
 - I. Chemicals.
 - J. Radiation.
 - K. Puncture.
 - L. Abrasion.
 - M. Heavy traffic.
 - N. Soiling, staining and corrosion.
 - O. Bacteria.
 - P. Rodent and insect infestation.
 - Q. Electrical current.
 - R. Improper lubrication.
 - S. Unusual wear or other misuse.
 - T. Contact between incompatible materials.
 - U. Misalignment.
 - V. Excessive weathering.
 - W. Unprotected storage.
 - X. Improper shipping or handling.
 - Y. Theft.
 - Z. Vandalism.

END OF SECTION 01 3100

SECTION 01 3119

PROJECT MEETINGS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section specifies administrative and procedural requirements for project meeting, including but not limited to: Pre-Construction Meeting, Pre-Installation Meeting, Coordination Meetings and Progress Meetings

1.3 PRE-CONSTRUCTION MEETING

- 1.3.1 A pre-construction meeting will be held at the Project site or other convenient location by the Construction Manager after execution of the Agreement and prior to commencement of the construction activities. The purpose of the meeting shall be to review responsibilities, personnel assignments and schedule.
- 1.3.2 Attendees shall include the Owner, Construction Manager, Architect and their consultants, all Contractors and/or their superintendents, major subcontractors, manufacturers, suppliers, and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- 1.3.3 The meeting may include such topics as: Construction Schedule, Critical Work Sequencing, Designation of Responsible Personnel, Procedures for Processing Field Decisions and Change Orders, Procedures for Processing Applications for Payment, Distribution of Contract Documents, Submittal of Shop Drawings, Product Data and Samples, Preparation of Record Documents, Use of the Premises, Office, Work and Storage Areas, Equipment Deliveries and Priorities, Safety Procedures, First Aid, Security, Housekeeping and Working Hours.

1.4 PRE-INSTALLATION MEETING

- 1.4.1 The Construction Manager may conduct a pre-installation meeting at the site before each construction activity that requires coordination with other construction. If a Pre-Installation Meeting is scheduled, the 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.

- 1.4.2 The purpose of the meeting will be to review the progress of other construction activities in preparation for the particular activity under consideration at each pre-installation conference, including requirements for: Contract Documents, Options, Related Change Orders, Purchases, Deliveries, Shop Drawings, Product Data and Quality Control Samples, Possible Conflicts, Compatibility Problems, Time Schedule, Weather Limitations, Manufacturer's Recommendations, Compatibility of Materials, Acceptability of Substrates, Temporary Facilities, Space and Access Limitations, Governing Regulations, Safety, Inspection and Testing Requirements, Required Performance Results, Recording Requirements, Protection
- 1.4.3 The Construction Manager shall record significant discussions and agreements and disagreements of each conference, along with the approved schedule. The Construction Manager shall distribute the record of the meeting to everyone concerned promptly, including the Owner and Architect. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

- 1.5.1 The Construction Manager will conduct progress meetings at regularly scheduled intervals.
- 1.5.2 In addition to representatives of the Owner, CM, and Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress. Progress Meetings are MANDATORY for those contractors working on site. The foreman or a dedicated worker MUST attend.
 - A. The Construction Manager reserves the right to delay payment to contractors who fail to attend weekly meetings while on-site.
- 1.5.3 The agenda shall include reviewing minutes of the previous progress meeting, review other items of significance that could affect progress. Other topics may include: Interface Requirements, Time, Sequences, Deliveries, Off-Site Fabrications Problems, Access, Site Utilization, Temporary Facilities and Services, Hours of Work, Hazards and Risks, Housekeeping, Quality and Work Standards, Change Orders and Documentation of Information for Payment Requests.
- 1.5.4 The meeting will also include a review of the Construction Schedule. Review progress since the last meeting. Determine where each activity is in relation to the Construction Manager'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.

- 1.5.5 Construction Manager will distribute copies electronically of minutes of the meeting to each party present and to other parties who should have been present. The Construction Manager shall also revise the Construction Schedule after each progress meeting where revisions to the Schedule have been made or recognized and will issue the revised Schedule concurrently with the report of each meeting.

2. PRODUCTS (Not Used)

3. EXECUTION (Not Used)

END OF SECTION 01 3119

SECTION 01 3300

SUBMITTAL PROCEDURES (Through BuildingBlok)

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

- A. Shop drawings and Samples
- B. Product data submittal procedures
- C. Shop Drawing and Samples Transmittal Form
- D. Contract Close-out Deliverables Form

- 1.2.1 Related Sections include the following:

- A. Division 01290 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
- B. Division 01400 Section "Quality Requirements" for submitting test and inspection reports.
- C. Division 01770 Section "Closeout Procedures" for submitting warranties.
- D. Division 01770 Section "Closeout Procedures" for submitting Record Drawings, Record Specifications, and Record Product Data.
- E. Division 01770 Section "Closeout Procedures" for submitting operation and maintenance manual.
- F. Division 01770 Section "Closeout Procedures" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
- G. Divisions 02000 through 16000 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

- 1.3.1 Action Submittals (Shop Drawings, Samples, Product Data, Catalog Cuts, etc.): Written and graphic information that requires Architect's and Construction Manager responsive action.

- 1.3.2 Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- 1.4.1 General: Electronic copies of CAD Drawings of the Contract Drawings may be provided at Architect's discretion and at extra cost to Contractor for use in preparing submittals.
- 1.4.2 Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- A. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - B. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 1. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- 1.4.3 Submittals Schedule: Provide the Construction Manager with a list of submittals and time requirements for scheduled performance of related construction activities.
- 1.4.4 Structural steel shop drawings: Prior to the submittal of shop drawings, Pre-submittal Drawings shall be submitted – refer to spec section 05 1200 Structural Steel Framing. The architect and structural engineer will review the Pre-submittal Drawings to clarify the design intent of the Construction Documents and provide additional information as required.
- 1.4.5 Processing Time: Allow enough 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.
- A. Initial Review: Allow twenty (20) calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - B. Resubmittal Review: Allow fifteen (15) calendar days for review of each resubmittal.
 - C. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow twenty (20) calendar days for initial review of each submittal.

D. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow fifteen (15) calendar days for review of each submittal. Submittal will be returned to Construction Manager, through the Architect, before being returned to Contractor.

1.4.6 Shop Drawing Submittal Procedures: The procedures and quantity of drawings, catalog cuts, samples and other information for submittal are minimum. The Contractor and Architect will finalize format at the Project Kick-Off Meeting. The direct submittal delivery procedures to affected parties is intended to expedite the review turn-around period by the Architect and his Consultants.

A. Information shall be submitted directly in the following manner:

1. All submittals both electronic and hard copy shall be submitted to the **Construction Manager first**.
2. If hard-copy submittals are required, Architectural, Mechanical and Electrical trades shall submit seven (7) copies to the Construction Manager. A minimum of two (2) copies shall be returned to the submitting contractor.

1.4.7. Identification: Place a permanent label or title block on each submittal for identification.

A. Indicate name of firm or entity that prepared each submittal on label or title block.

B. Provide a space approximately 4 x 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.

C. Include the following information on label for processing and recording action taken:

1. Project name
2. Date
3. Name and address of Architect and Construction Manager
4. Name and address of Contractor
5. Name and address of subcontractor
6. Name and address of supplier
7. Name of manufacturer
8. Submittal number or other unique identifier, including revision identifier.
 - a) Submittal number shall use whole numbers for the first submittal.
Example: Arch = A-001 / Mech = M-001 / Elect = E-001
 - b) Resubmittals for the same item shall be identified with the original first whole submittal number and the resubmitted number following the decimal point.
Example: Architectural = A-001.1 (first resubmittal)
9. Number and title of appropriate Specification Section
10. Drawing number and detail references, as appropriate

11. Location(s) where product is to be installed, as appropriate
12. Other necessary identification

1.4.8 Deviations: Highlight and encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

1.4.9 Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

- A. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
- B. Additional copies submitted for maintenance manuals will not be marked with Architect's Transmittal action review and will be discarded and returned only upon contractor's written request.

1.4.10 Transmittal: Package each submittal item individually and appropriately for transmittal and handling. Transmit each submittal including the information below. Architect received submittals from sources other than Construction Manager or General Contractor will be discarded without review.

A. Information to be included on transmittal:

1. Project name
2. Date
3. Destination (To:)
4. Source (From:)
5. Names of subcontractor, manufacturer, and supplier
6. Category and type of submittal
7. Submittal purpose and description
8. Specification Section number and title
9. Drawing number and detail references, as appropriate
10. Transmittal number, numbered consecutively
11. Submittal and transmittal distribution record
12. Remarks
13. Signature of transmitter

1.4.11 Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

- A. Note date and content of previous submittal.
- B. Note date and content of revision in label or title block and clearly indicate extent of revision.
- C. Resubmit submittals until they are marked with Architect's "REVIEWED FOR CONSTRUCTION" or Architect's "REVIEWED AS NOTED" stamp and Construction Manager action stamp.

1.4.12 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.

1.4.13 Use for Construction: Use only final submittals with mark indicating Architect's "REVIEWED FOR CONSTRUCTION" or "REVIEWED AS NOTED" stamp and Construction Manager or General Contractor's release for construction stamp.

A. DO NOT USE Shop Drawings noted "XRR = RETURNED FOR CORRECTIONS" for construction or fabrication.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

1.5.1 General: At Contractor's written request, copies of Architect's CAD files may be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

A. Architect may require a payment or fee for use of CAD Drawings.

PART 2 PRODUCTS

2.1 ACTION SUBMITTALS

2.1.1 General: Prepare and submit Action Submittals required by individual Specification Sections.

A. Submit electronic submittals by email to the Construction Manager or directly to extranet specifically established for Project.

B. Submit hard copies direct to the Construction Manager.

2.1.2 Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

A. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

B. Mark each copy of each submittal to show which products and options are applicable.

C. Include the following information, as applicable:

1. Manufacturer's written recommendations
2. Manufacturer's product specifications
3. Manufacturer's installation instructions
4. Standard color charts
5. Manufacturer's catalog cuts
6. Wiring diagrams showing factory-installed wiring
7. Printed performance curves
8. Operational range diagrams
9. Mill reports
10. Standard product operating and maintenance manuals

- 11. Compliance with specified referenced standards
- 12. Testing by recognized testing agency
- 13. Application of testing agency labels and seals
- 14. Notation of coordination requirements
- D. Submit Product Data concurrent with Samples.
- E. Number of Copies: Submit copies as indicated in Part 1.4 "Submittal Procedures".

2.1.3 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.

- A. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - 1. Dimensions
 - 2. Identification of products
 - 3. Fabrication and installation drawings
 - 4. Roughing-in and setting diagrams
 - 5. Wiring diagrams showing field-installed wiring, power, signal, and control wiring
 - 6. Shop work manufacturing instructions
 - 7. Templates and patterns
 - 8. Schedules
 - 9. Design calculations
 - 10. Compliance with specified standards
 - 11. Notation of coordination requirements
 - 12. Notation of dimensions established by field measurement
 - 13. Relationship to adjoining construction clearly indicated
 - 14. Seal and signature of professional engineer if specified
 - 15. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
- B. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
- C. Number of Copies: Submit copies as indicated in Part 1.4 "Submittal Procedures".

2.1.4 Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

- A. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
- B. Identification: Attach label on unexposed side of Samples that includes the following:
 - 1. Generic description of Sample

2. Product name and name of manufacturer
 3. Sample source
 4. Number and title of appropriate Specification Section
- C. 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.
1. 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.
 2. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- D. 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.
1. Number of Samples: Submit one (1) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
- E. 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 variations 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.
1. Number of Samples: Submit number of samples as indicated in Part 1.4 "Submittal Procedures".
 - a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - b. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.
- 2.1.5 Product Schedule or List: 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:
- A. Type of product. Include unique identifier for each product.
 - B. Room name, room number, space and location

- 2.1.6 Application for Payment: Comply with requirements specified in Division 01 Section "Payment Application Procedures."
- 2.1.7 Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Application Procedures."
- 2.1.8 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:
 - A. Name, address, and telephone number of entity performing subcontract or supplying products.
 - B. Number and title of related Specification Section(s) covered by subcontract.
 - C. Drawing number and detail references, as appropriate, covered by subcontract.
 - D. Number of Copies: Submit two (2) copies of subcontractor list, unless otherwise indicated.

2.2 INFORMATIONAL SUBMITTALS

- 2.2.1 General: Prepare and submit Informational Submittals required by other Specification Sections.
 - A. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
 - B. Certificates and Certifications: Provide a notarized 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.
 - C. Test and Inspection Reports: Comply with requirements in Division 01 4000 Section "Quality Requirements."
- 2.2.2 Coordination Drawings: Comply with requirements specified in Division 01 3100 Section "Project Management and Coordination."
- 2.2.3 Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- 2.2.4 Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

- 2.2.5 Installer Certificates: Prepare 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.
- 2.2.6 Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- 2.2.7 Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- 2.2.8 Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- 2.2.9 Material Test Reports: Prepare 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.
- 2.2.10 Product Test Reports: Prepare written reports indicating 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.
- 2.2.11 Research/Evaluation Reports: Prepare 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
- 2.2.12 Schedule of Tests and Inspections: Comply with requirements specified in Division 01 4000 Section "Quality Requirements."
- 2.2.13 Preconstruction Test Reports: Prepare 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.
- 2.2.14 Compatibility Test Reports: Prepare 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 primers and substrate preparation needed for adhesion.

- 2.2.15 Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.
- 2.2.16 Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 7700 Section "Closeout Procedures" for Operation and Maintenance Data."
- 2.2.17 Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- 2.2.18 Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - A. Preparation of substrates
 - B. Required substrate tolerances
 - C. Sequence of installation or erection
 - D. Required installation tolerances
 - E. Required adjustments
 - F. Recommendations for cleaning and protection
- 2.2.19 Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - A. Name, address, and telephone number of factory-authorized service representative making report.
 - B. Statement on condition of substrates and their acceptability for installation of product.
 - C. Statement that products at Project site comply with requirements.
 - D. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - E. Results of operational and other tests and a statement of whether observed performance complies with requirements.

- F. Statement whether conditions, products, and installation will affect warranty.
- G. Other required items indicated in individual Specification Sections.

2.2.20 Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles and term of the coverage.

2.2.21 Material Safety Data Sheets (MSDSs): Submit information directly to Construction Manager; do not submit to Architect, except as required in "Action Submittals' Article."

- A. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

2.3.1 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.

- A. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

2.3.2 Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three (3) copies of 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.

- A. 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.

PART 3 EXECUTION

3.1 CONTRACTOR'S REVIEW

3.1.1 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 Contractor's review approval stamp before submitting to Architect.

3.1.2 Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, 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.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER CONSTRUCTOR'S ACTION

- 3.2.1 General: Architect will not review submittals that do not bear Construction Manager or General Contractor's review approval stamp and will return them without action.
- 3.2.2 Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action to be taken.
- 3.2.3 Informational Submittals: Architect will review each submittal and will return it to the Construction Manager or General Contractor with review comments for their review.
- 3.2.4 Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

END OF SECTION 01 3300

SECTION 01 4000

QUALITY REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements for quality assurance and quality control.
- 1.2.2 Testing and inspecting 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.
 - A. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - B. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - C. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, CM, or authorities having jurisdiction are not limited by provisions of this Section.
- 1.2.3 Related Sections include the following:
 - A. Division 01732 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
 - B. Divisions 02 through 17 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- 1.3.1 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.

- 1.3.2 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. Services do not include contract enforcement activities performed by Architect or CM.
- 1.3.3 Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- 1.3.4 Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- 1.3.5 Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- 1.3.6 Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- 1.3.7 Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- 1.3.8 Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- 1.3.9 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, and similar operations.

1.4 CONFLICTING REQUIREMENTS

- 1.4.1 General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

- 1.4.2 Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements.

1.5 SUBMITTALS

- 1.5.1 Qualification Data: 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.
- 1.5.2 Schedule of Tests and Inspections: Prepare in tabular form and include the following:
- A. Specification Section number and title.
 - B. Description of test and inspection.
 - C. Identification of applicable standards.
 - D. Identification of test and inspection methods.
 - E. Number of tests and inspections required.
 - F. Time schedule or time span for tests and inspections.
 - G. Entity responsible for performing tests and inspections.
- 1.5.3 Reports: Prepare and submit certified written reports that include the following:
- A. Date of issue.
 - B. Project title and number.
 - C. Name, address, and telephone number of testing agency.
 - D. Dates and locations of samples and tests or inspections.
 - E. Names of individuals making tests and inspections.
 - F. Description of the Work and test and inspection method.
 - G. Identification of product and Specification Section.
 - H. Test and inspection results and an interpretation of test results.
 - I. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - J. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - K. Name and signature of laboratory inspector.
 - L. Recommendations on retesting and reinspecting.
- 1.5.4 Permits, Licenses, and Certificates: For Owner's records, 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.

1.6 QUALITY ASSURANCE

- 1.6.1 General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- 1.6.2 Installer Qualifications: A firm or individual experienced in installing, erecting, 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.
- 1.6.3 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.
- 1.6.4 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.
- 1.6.5 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 to those indicated for this Project in material, design, and extent.
- 1.6.6 Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - A. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- 1.6.7 Testing Agency Qualifications: An NRTL, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - A. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

- 1.6.8 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.
- 1.6.9 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:
- A. Contractor responsibilities include the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - 5. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - 6. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - B. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through CM, 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.
- 1.6.10 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:
- A. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or CM.
 - B. Notify Architect and CM seven (7) calendar days in advance of dates and times when mockups will be constructed.
 - C. Demonstrate the proposed range of aesthetic effects and workmanship.
 - D. Obtain Architect's and CM's approval of mockups before starting work, fabrication, or construction.
 - 1. Allow seven (7) calendar days for initial review and each re-review of each mockup.
 - E. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - F. Demolish and remove mockups when directed, unless otherwise indicated.

- 1.6.11 Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through Divisions 33.

1.7 QUALITY CONTROL

- 1.7.1 Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- A. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - B. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 - C. 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.**
- 1.7.2 Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. 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.
- A. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - B. Notify testing agencies at least forty-eight (48) hours in advance of time when Work that requires testing or inspecting will be performed.
 - C. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - D. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - E. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- 1.7.3 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 Division 01330 Section "Submittal Procedures."
- 1.7.4 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.

- 1.7.5 Testing Agency Responsibilities: Cooperate with Architect, CM, and Contractors in performance of duties. Provide qualified personnel to perform required tests and inspections.
- A. Notify Architect, CM, and Contractors promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - B. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - C. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - D. Submit a certified written report, in duplicate, of each test, inspection, and similar quality control service through Contractor.
 - E. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - F. Do not perform any duties of Contractor.
- 1.7.6 Associated Services: Cooperate with agencies 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.
- A. Incidental labor and facilities necessary to facilitate tests and inspections.
 - B. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - C. Facilities for storage and field curing of test samples.
 - D. Delivery of samples to testing agencies.
 - E. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - F. Security and protection for samples and for testing and inspecting equipment at Project site.
- 1.7.7 Coordination: Coordinate sequence of activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
- A. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.7.8 Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within thirty (30) calendar days of date established for **commencement of the Work** or **the Notice to Proceed**.
- A. Distribution: Distribute schedule to Owner, Architect, CM, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

- 1.8.1 Special Tests and Inspections: Owner may engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
- 1.8.2 Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - A. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - B. Notifying Architect, CM, and Contractors promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - C. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, CM, with copy to Contractors and to authorities having jurisdiction.
 - D. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - E. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - F. Retesting and reinspecting corrected work.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

- 3.1.1 CM and Owner will select testing agency before construction begins.
 - A. CM/Constructor or Contractor may recommend testing agency firm to the Architect or Owner for decision.

3.2 TEST AND INSPECTION LOG

- 3.2.1 Prepare a record of tests and inspections. Include the following:
 - A. Date test or inspection was conducted.
 - B. Description of the Work tested or inspected.
 - C. Date test or inspection results were transmitted to Architect.
 - D. Identification of testing agency or special inspector conducting test or inspection.

- 3.2.2 Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's and CM's reference during normal working hours.

3.3 REPAIR AND PROTECTION

- 3.1.1 General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - A. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
 - B. Comply with the Contract Document requirements for Division 01732 Section "Cutting and Patching."
- 3.1.2 Protect construction exposed by or for quality-control service activities.
- 3.1.3 Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

- A. Temporary utilities, services and facilities will be provided by the Owner through the CM unless otherwise noted or directed by the CM.

- 1. Each Contractor shall provide their own hoisting, loading and unloading.
 - 2. Contractors shall arrange for, and schedule, all deliveries during their own normal workday hours.
 - 3. **EACH CONTRACTOR IS RESPONSIBLE FOR THEIR OWN WINTER PROTECTION AS IT RELATES TO YOUR SCOPE OF WORK.**

- 1.2.2 Temporary Utilities include, but are not limited to:

- A. Temporary Water Service
 - 1. By Owner
- B. Temporary Electric, Power and Light
 - 1. By Electrical Contractor

- 1.2.3 Temporary Construction and Support Facilities include, but are not limited to:

- A. Temporary Heat – CM will direct contractor to hook up temporary building heat on a Time & Materials basis. The Owner will pay for utility usage.
- B. Field Offices
 - 1. By Each Trade Contractor
- C. Temporary Toilets
 - 1. By Owner
- D. Dumpster
 - 1. By Owner

- a. **Dumpster is for minor debris only.** No Masonry, Concrete, Pallets or other major items are allowed. CM will back charge contractor for misuse of Dumpster.
- b. Cleanup is the responsibility of each Bid Category. If necessary, CM will cleanup and back charge contractors accordingly (Refer to Section 017100).

E. Temporary Enclosures

1. Temporary Supports

- a. All Bid Categories shall include all costs necessary to brace their work as required per MIOSHA to maintain progress. This is required for the duration of the project.

2. Temporary Partitions

- a. By Owner

3. Building Enclosures (As Directed By CM) on a T&M basis.

- a. By General Trades Contractor

1.2.4 Security and protection facilities required include, but are not limited to:

A. Temporary Fire Protection

- 1. By General Trade Contractor

B. Barricades, Warning Lights, Signs, Etc.

- 1. By Each Trade Contractor per MIOSHA Regulations

C. Environmental Protection

- 1. By Each Trade Contractor

1.3 QUALITY ASSURANCE

1.3.1 Regulations: Comply with industry standards and applicable laws and regulation for authorities having jurisdiction including, but not limited to:

- A. Building Code Requirements
- B. Health and Safety Regulations
- C. Utility Company Regulations
- D. Environmental Protection Regulations

1.3.2 Standards: Comply with the following codes and standards:

- A. NFPA Code 241 – “Building Construction and Demolition Operations”
- B. ANSI-A10 Series – “Safety Requirements for Construction and Demolition”
- C. NECA Electrical Design Library – “Temporary Electrical Facilities”

- 1.3.3 Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services," prepared jointly by AGC and ASC for industry recommendations.
- 1.3.4 Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- 1.3.5 Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certification and permits.

1.4 PROJECT CONDITIONS

- 1.4.1 When acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- 1.4.2 Conditions of Use:
 - A. Keep temporary services and facilities clean and neat in appearance
 - B. Operate in a safe and efficient manner
 - C. Take necessary fire prevention measures
 - D. Do not overload facilities or permit them to interfere with progress
 - E. Do not allow hazardous, dangerous, unsanitary conditions or public nuisances to develop or persist on the site.

2. PRODUCTS

2.1 MATERIALS

- 2.1.1 General – Provide new materials or undamaged previously used materials in serviceable condition.
- 2.1.2 Lumber and Plywood – For safety barriers, sidewalks, bridges and similar uses, provide minimum 5/8" thick exterior plywood.
- 2.1.3 Tarpaulins – Provide waterproof, fire resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures; provide translucent, nylon, reinforced, laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- 2.1.4 Water – Use Potable Water.

2.2 EQUIPMENT

- 2.2.1 Water Hoses – Shall be 3/4" heavy-duty, abrasion resistant, flexible, rubber hoses with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shut-off nozzles at hose discharge.

- 2.2.2 Electrical Outlets – Properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment (Refer to Section 16000 – Electrical).
- 2.2.3 Electrical Power Cords – Shall be provided by each Bid Category and shall be ground extension cords. Use “hard-service” cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress.
- 2.2.4 Heating Units – Temporary heating units shall be tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- 2.2.5 Temporary Offices – Each Contractor shall provide prefabricated or mobile units with lockable entrances, operable windows, and serviceable finishes. Provide heated units on foundations adequate for normal loading. Construction Manager is not responsible for temporary offices, trailers, or the contents inside such trailers.
- 2.2.6 Temporary Toilet Unit – Provided by Owner
- 2.2.7 First Aid Supplies – Each Bid Category Contractor shall comply with governing regulations.
- 2.2.8 Fire Extinguishers – Shall be portable UL-rated, Class “A” fire extinguishers for temporary offices and similar spaces. In other locations, provide portable, UL-rated, Class “ABC” dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for the exposures.
 - A. Comply with NFPA 10 *AND* 241 for classification, extinguishing agent and size required by location and class of fire exposure.

3. EXECUTION

3.1 INSTALLATION

- 3.1.1 Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as directed by the Construction Manager.
- 3.1.2 Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- 3.2.1 Owner will provide permanent power to main transformer pad. As soon as possible, contractors may have to supply portable generators until temporary power is established or during shutdown if required.
 - A. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary service (Refer to Section 16000).
 - B. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services (Refer to Section 16000).
- 3.2.2 Temporary Electric Power Service – Provide a minimum of four receptacles every 1000 square feet or as necessary to provide sufficient power for contractors' work.
- 3.2.3 Power Distribution System – Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 volts, AC 20 ampere rating and lighting circuits may be non-metallic sheathed cable where overhead and exposed for surveillance.
- 3.2.4 Temporary Lighting – Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operation and traffic conditions. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching (Refer to Section 16000).
- 3.2.5 Temporary Telephone – At each telephone, a list of emergency numbers shall be posted. Contractors may use Construction Manager's for emergency purposes only.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- 3.3.1 Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
 - A. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
 - B. Each Contractor is responsible for electrical hook-up to their trailers.
 - C. Any electric heaters or Air Conditioners used for heating or cooling will be metered and paid for by that Contractor.
- 3.3.2 Provide incombustible construction for offices, shops, and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.

- 3.3.3 Temporary Heat – Provide temporary heat required by construction activities for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- 3.3.4 Heating Facilities – Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
- A. Use of gasoline burning space heaters, open flame or salamander type heating units is prohibited.
 - B. Any electric heaters used for temporary heating will not be approved unless approved in writing before bid date.
- 3.3.5 Mechanical and electrical contractors shall expedite their work so that completed or partially completed permanent heating installation may be used as soon as possible. Requirements for temporary use of these systems are as follows:
- A. Do not use permanent duct system until filter units are installed. Change or clean filters frequently and install new filters at completion. Filters may be cleaned only if they are type intended for cleaning. Clean filters in accordance with manufacturer's directions.
 - B. Thoroughly clean permanent convectors or other permanent space heaters used for temporary heating units. Restore units to original finish at completion of the Work.
 - C. Set permanent space heaters temporarily, if in the judgment of the Construction Manager, use is required to maintain reasonable temperatures and required to properly dry out the building. Automatic devices, permanent or temporary, shall control temperatures in all areas. Thoroughly clean valves and traps installed with the units and adjust just prior to project completion.
 - D. The Owner through the CM shall maintain and operate the temporary building heating system and pay for utility usage costs.
 - E. Costs for fuel, water and electric power required to operate heating system shall be paid by Owner. Other costs shall be paid by the trade contractor, including costs of providing and installing units, placing and replacing filters, reconditioning units and wages of labor required to operate the system. The Electrical Contractor is to hook up the power to the temporary heaters.
- 3.3.6 Temporary Lifts and Hoists – All Bid Categories are to provide their own facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

- 3.3.7 Project and Temporary Signage – The Owner through the Construction Manager will provide all Project and Directional Signage. All Bid Categories must receive approval from the Construction Manager before installing any signage. The CM reserves the right to remove any and all signage from the Project Site.
- 3.3.8 Temporary Exterior Lighting – Install exterior yard and sign lights so that signs are visible when work is being performed.
- 3.3.9 Collection and Disposal of Waste – By all Bid Categories as required. Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. ENFORCE REQUIREMENTS STRICTLY. Do not hold materials more than seven days during normal weather or three days when the temperature is expected to rise above 80° Fahrenheit (27° Celsius). Handle hazardous, dangerous or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- 3.4.1 Except for use of permanent fire protection, as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as directed by the CM.
- 3.4.2 Temporary Fire Protection – Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 “Standard for Portable Fire Extinguishers” and NFPA 241 “Standard for Safeguarding Construction, Alterations and Demolition Operations.”
 - A. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher for every 100ft. (per MIOSHA Rules and Regulations).
 - B. Store combustible materials in containers in fire-safe locations.
 - C. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, egress exits and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - D. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- 3.4.3 Permanent Fire Protection – At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- 3.4.4 Barricades, Warning Signs and Lights – Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.

- 3.4.5 Temporary Gates and Fencing – To be maintained, locked and kept secure on a daily basis by Construction Manager. The Trade Contractors are expected to participate in locking the site especially if they are working after-hours.
- 3.4.6 Security Enclosure and Lock-up – Installed and maintained by the Construction Manager. Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
- 3.4.7 Storage – To be maintained in storage trailers unless approved by Construction Manager. Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lock-up. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- 3.4.8 Environmental Protection – Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and minimize the possibility that air, waterways and subsoil must be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons of firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

- 3.5.1 Supervision – Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- 3.5.2 Maintenance – Each Bid Category is required to maintain the temporary facilities that they installed. Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
- 3.5.3 Termination and Removal – Unless the CM requests that it be maintained longer, remove each temporary facility as the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete, or if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
 - A. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project Identification Signs.

- B. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances, as required by the governing authority.
- C. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period including but not limited to:
 - 1. Replace air filters and clean inside of ductwork and housings.
 - a. By Mechanical Contractor
 - 2. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - a. By Mechanical Contractor
 - 3. Replace lamps that are burned out or noticeable dimmed by substantial hours of use. Clean light lenses and diffusers.
 - a. By Electrical Contractor

END OF SECTION 01 5000

SECTION 01 6000

PRODUCT REQUIREMENTS

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

- A. Substitutions Request Procedures
- B. Product Substitutions and Options

- 1.2.2 Related Sections include the following:

- A. Division 01770 Section "Closeout Procedures" for submitting warranties for contract closeout.
- B. Divisions 02 through 17 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

- 1.3.1 Products: Items purchased 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.

- A. 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.
- B. New Products: Items that have not previously been incorporated into another project or facility, **except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise.** Products salvaged or recycled from other projects are not considered new products.

C. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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.

1.3.3 Substitutions (after selection of successful bidder): Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3.4 Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3.5 Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

1.3.6 Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

1.4.1 Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

A. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.

B. Form: Tabulate information for each product under the following column headings:

1. Specification Section number and title
2. Generic name used in the Contract Documents
3. Proprietary name, model number, and similar designations
4. Manufacturer's name and address
5. Supplier's name and address
6. Installer's name and address
7. Projected delivery date or time span of delivery period
8. Identification of items that require early submittal approval for scheduled delivery date

- C. Initial Submittal: Within thirty (30) calendar days after date of "Notice to Proceed," or date of commencement of work, submit three (3) copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - 1. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
- D. Completed List: Within sixty (60) calendar days after date of "Notice to Proceed," submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
- E. Architect's Action: Architect will respond in writing to Contractor within fifteen (15) calendar days of receipt of completed product list. Architect's response will include a list of unacceptable product selections without explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

1.4.2 Substitution Requests Procedures: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

- A. Substitution Request must be proposed and submitted only to the CM/Constructor or General Contractor. Substitution Requests must not be sent directly to the Architect.
- B. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - 1. Statement indicating why specified material or product cannot be provided.
 - 2. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and other separate Contractors, that will be necessary to accommodate proposed substitution.
 - 3. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - 5. Samples, where applicable or requested.
 - 6. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

7. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 8. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 9. Detailed comparison of Contractor's Construction Schedule using proposed substitution 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 lack of availability or delays in delivery.
 10. Cost information, including a proposal of change, if any, in the Contract Sum.
 11. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 12. 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.
- C. Architect/Engineer shall have right to reject proposed substitution without explanation.
- D. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within Seven (7) calendar days of receipt of a request for substitution. Architect will notify General Contractor or CM/Constructor of acceptance or rejection of proposed substitution within Ten (10) calendar days of receipt of request, or Seven (7) calendar days of receipt of additional information or documentation, whichever is later.
1. **Should the Architect not respond within Twelve (12) calendar days of the dated date of Request, the proposed substitution is considered REJECTED.**
 2. Form of Acceptance: Construction Change Directive (CCD).
 3. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
 4. Owner or Architect does not have to give any reason for rejection of substitutions.

1.4.3 Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01330 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

- A. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
- B. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.6.1 Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

- A. 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.
- B. 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.
- C. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- D. Store products to allow for inspection and measurement of quantity or counting of units.
- E. Store materials in a manner that will not endanger Project structure.
- F. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- G. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- H. Protect stored products from damage.

1.6.2 Owner's Storage Area: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- 1.7.1 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.
- 1.7.2 Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

- A. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
- B. Refer to Divisions 02 through Divisions 17 Sections for specific content requirements and particular requirements for submitting special warranties.

1.7.3 Submittal Time: Comply with requirements in the following:

- A. Division 01330 Section "Submittal Procedures."
- B. Division 01770 Section "Closeout Procedures."

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS and SUBSTITUTIONS

2.1.1 General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

- A. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
- B. 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.
- C. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- D. Where products are accompanied by the term "as selected," Architect will make selection.
- E. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
- F. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- G. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product acceptable to the Architect.

2.1.2 Product Selection Procedures: Procedures for product selection include the following:

- A. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
 - 1. The product is a single source item.
Substitutions will not be considered.

- B. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - 1. Substitutions may be considered.
- C. Manufacturer's Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - 1. Substitutions will not be considered.
- D. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - 1. Substitutions by non-listed manufacturers will not be considered.
- E. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by a specified manufacturer. Comply with provisions in "Product Substitutions" Article.
- F. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, design profiles, dimensions, and other characteristics that are based on the product named.
 - 1. Provide Basis-of Design product or by one of the listed manufacturers.
 - 2. Substitutions of other products will not be considered.
- G. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 - 1. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
- H. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS CRITERIA

- 2.2.1 Timing: Architect may consider requests for substitution if received within thirty (30) calendar days after the "Notice to Proceed" or before the first (1st) "Application for Payment." Requests received after that time may be considered or rejected at discretion of Architect without explanation.
- 2.2.2 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 or reason, 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 affect work of other Trades Contractor's construction time 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.

2.3 COMPARABLE PRODUCTS

2.3.1 Where products or manufacturers are specified by name (except noted as "basis-of-design), submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

- A. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
- B. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
- C. Evidence that proposed product provides specified warranty.
- D. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
- E. Samples, if requested.

END OF SECTION 01 6000

SECTION 01 7400

CLEANING AND DEBRIS CONTROL

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 Contractors are required to perform cleanup on a regular basis. Cleanup consists of removing all trash and leftover materials from the building as a result of their work. Cleanup also consists of regular housekeeping to reduce the amount of dust and dirt brought into the building by workers entering and exiting the building. ALL trade contractors are to participate in general cleanup and housekeeping.
- 1.2.2 The Construction Manager (CM) reserves the right to act on behalf of the Owner pertaining to the cleaning and debris control responsibilities that are part of each Contractor's Work. The CM shall also be responsible for the following:
 - A. Oversee daily and weekly cleaning and ensure that the building and grounds are kept free from accumulation of waste materials, rubbish, debris, dirt and dust.
 - B. Oversee work activities and ensure work is being performed by contractors to minimize the amount of dust that is created. Contractors are to follow all MIOSHA procedures including performance of their work using proper procedures as found in the new MIOSHA Silica Standards.
 - C. Providing and scheduling exchanges of dumpsters as required.
- 1.2.3 Final Cleaning will be performed by the owner or a company hired by the owner.

2. PROCEDURES

2.1 WET SWEEPING

- 2.1.1 Wet sweeping may be performed prior to roof installation. Floors can be sprayed and broom swept.

2.2 HEPA VACUUMING

- 2.2.1 Once roof is installed, contractors are to use HEPA Vacuuming for general cleanup and on cleanup days as described in the MIOSHA Silica Standards.

3. EXECUTION

3.1 DAILY CLEANING

- 3.1.1 Each Bid Category Contractor shall execute cleaning to ensure that the building and grounds are kept free from accumulation of waste materials, rubbish, debris, dirt and dust.
- A. Daily, during progress of work, each Contractor shall clean site and public properties and dispose of waste materials, debris and rubbish in dumpsters provided by the Construction Manager.
 - B. Each Contractor shall handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
 - C. Each Contractor shall provide and maintain garbage cans for the removal of personal trash resulting from breaks and lunches. These are to be emptied on a regular basis.
 - D. Each Contractor to maintain cleaning throughout the duration of the Project.

3.2 ROUTINE CLEANING (WEEKLY)

- 3.2.1 On a weekly basis or on a day directed by the Construction Manager, each Contractor shall perform an overall clean-up of the entire site including wet sweeping and/or use of HEPA vacuum of appropriate surfaces. Rubbish and debris shall be removed from the building site to the Owner provided dumpster immediately but no later than the day of weekly cleaning.
- A. Each Contractor shall use experienced workmen for cleaning, both in the amount required and for the necessary duration, to maintain the building site in a clean condition, as directed by the CM.
 - B. Each Contractor shall remove dirt, mud and other foreign materials from all interior and exterior surfaces.
 - C. Each Contractor to maintain cleaning throughout the duration of the Project.
 - D. Should the contractor fail in the performance of this Work, the Owner may perform such Work in accordance with Article 3 of the General Conditions.

3.3 FINAL CLEANING

- 3.3.1 Final Cleaning will be by Owner as a separate Bid Category.

END OF SECTION 01 7400

SECTION 01 7700

PROJECT CLOSEOUT PROCEDURES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

- A. Substantial Completion and Inspection procedures.
- B. Warranties.
- C. List of incomplete items (punch list).
- D. Project Record Documents.
- E. Operation and maintenance manuals.
- F. Demonstration and Training of Owner's Personnel.
- G. Final Cleaning.

- 1.2.2 Related Sections include, but not limited to the following:

- A. Divisions 02 0000 through Divisions 33 0000 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

- 1.3.1 Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

- A. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
- B. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
- C. Utilities. Include occupancy permits, operating certificates, and similar releases.
- D. Prepare and submit Project Record Documents, operation and maintenance manuals.
- E. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

- F. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
- G. Complete startup testing of systems.
- H. Submit test/adjust/balance records.
- I. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- J. Advise Owner of changeover in heat and other utilities.
- K. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- L. Complete final cleaning requirements, including touchup painting.
- M. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

1.3.2 Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Construction Manager 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.

- A. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- B. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 WARRANTIES

- 1.4.1 All materials and installation have a minimum of a 12 month warranty from the date of substantial completion. Additional warranties are specified in the individual specification sections.
- 1.4.2 Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- 1.4.3 Partial Occupancy: Submit properly executed warranties within fifteen (15) calendar 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.
- 1.4.4 Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - A. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

- B. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
- C. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

1.4.5 Provide additional copies of each warranty to include in operation and maintenance manuals.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

1.5.1 Preparation: Submit two (2) copies 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.

- A. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
- B. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
- C. Include the following information at the top of each page:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect and Construction Manager.
 - 4. Name of Contractor.
 - 5. Page number.

1.6 PROJECT RECORD DOCUMENTS

1.6.1 General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's and Construction Manager's reference during normal working hours.

1.6.2 Record As-Built Drawings: Maintain one (1) and submit one (1) set of black-line white prints of Contract Drawings and Shop Drawings to Architect.

- A. 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 prepare the marked-up Record Prints.
 - 1. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - 2. Accurately record information in an understandable drawing technique.
 - 3. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

4. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 - B. Mark record sets with non-erasable, red-colored ink. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - C. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - D. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - E. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- 1.6.3 Record Specifications: Submit one (1) copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
- A. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - B. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - C. Note related Change Orders, Record Drawings, and Product Data, where applicable.
- 1.6.4 Record Product Data: Submit one (1) copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
- A. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - B. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - C. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.
- 1.6.5 Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Assemble and submit one (1) complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

A. Operation Manuals:

1. Emergency and Standard instructions and procedures.
2. System, subsystem, and equipment descriptions, including operating standards.
3. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
4. Description of controls and sequence of operations.
5. Piping diagrams.

B. Emergency Manuals:

1. Types of Emergencies: Fire, Flood, Gas leak, Electrical Power Outage, Chemical, Equipment failure and etc.
2. Instructions and Procedures for Shut-Down and Start-Up.

C. Maintenance Data:

1. Manufacturer's information, including list of spare parts.
2. Name, address, and telephone number of Installer or supplier.
3. Maintenance procedures.
4. Maintenance and service schedules for preventive and routine maintenance.
5. Maintenance record forms.
6. Sources of spare parts and maintenance materials.
7. Copies of maintenance service agreements.
8. Copies of warranties and bonds.

1.7.2 Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

2. PRODUCTS

2.1 MATERIALS

2.1.1 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.

3. EXECUTION

3.1 DEMONSTRATION AND TRAINING

- 3.1.1 Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- A. Provide instructors experienced in operation and maintenance procedures.
 - B. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 - C. Schedule training with Owner, through Construction Manager, with at least seven (7) calendar days' advance notice.
 - D. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
 - E. Submit two (2) copies of instructional and demonstration of training procedures.
- 3.1.2 Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
- A. System design and operational philosophy.
 - B. Review of documentation.
 - C. Operations.
 - D. Adjustments.
 - E. Troubleshooting.
 - F. Maintenance.
 - G. Repair.

3.2 FINAL CLEANING

- 3.2.1 General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations and all other governing agencies having jurisdiction on the project.
- A. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project as acceptable to the Architect.
 - 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - 3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 4. Remove tools, construction equipment, machinery, and surplus material from Project site.

5. 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.
6. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
7. Sweep concrete floors broom clean in unoccupied spaces.
8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
9. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
10. Remove labels that are not permanent.
11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
12. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
13. Replace parts subject to unusual operating conditions.
14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
16. Clean ducts, blowers, and coils if units were operated without filters during construction.
17. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
18. Leave Project clean and ready for occupancy.

- 3.2.2 Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 7700

SECTION 01 7836

WARRANTIES

1. GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- 1.2.1 This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
 - A. General close-out requirements are included in Section "Project Close-out."
 - B. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2-16.
 - C. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.
- 1.2.2 Disclaimers and Limitations – Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporated the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
- 1.2.3 Separate Contracts – Each Contractor is responsible for warranties related to its own Contract.

1.3 DEFINITIONS

- 1.3.1 STANDARD PRODUCT WARRANTIES are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- 1.3.2 SPECIAL WARRANTIES are written warranties required by or incorporated in the Contract Documents, either to extend the time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- 1.4.1 Related Damages and Losses – When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of the warranted Work.
- 1.4.2 Reinstatement of Warranty – When Work covered by a warranty has failed and been corrected by replacement or rebuilding; reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- 1.4.3 Replacement Cost – Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- 1.4.4 Owner's Recourse – Written warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.
- 1.4.5 Rejection of Warranties – The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- 1.4.6 The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- 1.5.1 Submit written warranties to the CM prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
- 1.5.2 When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the CM within (15) days of completion of that designated portion of the Work.

- 1.5.3 The Contractor shall submit a letter of warranty to the Owner, through the CM, which guarantees his workmanship for a period of one year from the completion date of the Contract unless otherwise indicated.
- 1.5.4 When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification ready for execution by the required parties. Submit a draft to the Owner through the CM for approval prior to final execution.
- 1.5.5 Form of Submittal – At final completion, compile two copies of each required warranty and bond properly executed by the Contractor, subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents in the Project Manual.
- 1.5.6 Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring vinyl covered, loose-leaf binders thick enough for the contents and available to receive standard sized paper.
 - A. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product and the name, address, and phone of the installer
 - B. Identify each binder on the front and the spine with the typed or printed title “Warranties and Bonds” with the Project Title and name of the Contractor.
- 1.5.7 When Operating and Maintenance Manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

2. PRODUCTS (Not Applicable)

3. EXECUTION

3.1 SCHEDULE OF WARRANTIES

- 3.1.1 Schedule – Provide warranties and bonds on products and installations as specified in the Technical Specification.

END OF SECTION 01 7836

PROJECT MANUAL

Additions and Renovations To:
Hunger Solution Center
940 E. Genesee Ave.
Saginaw, MI 48607

Prepared For:



Prepared By:



Project Number: **2154**

Date: **BID SET JULY 3, 2025**

DOCUMENT 00010

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END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control of installation.
- B. References.
- C. Inspection, Construction Staking/Surveying, and testing laboratory services.

1.2 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply fully with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform work by persons qualified to produce workmanship of specified quality.
- F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 REFERENCES

- A. Conform to reference standard by date of issue current on date of Contract Documents.
- B. Obtain copies of standards when required by Contract Documents.
- C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 FIELD SAMPLES

- A. Acceptable samples represent a quality level for the Work.

1.6 INSPECTION, CONSTRUCTION STAKING / SURVEYING, AND TESTING LABORATORY SERVICES

- A. General Contractor / CM will appoint, employ, and pay for services of Engineer (MLR Engineering) to perform construction staking/surveying, and material and compaction testing. General Contractor / CM will appoint, employ, and pay for the services of the Engineer (MLR Engineering) to perform utility inspection and related testing as required by the Municipality.
- B. The expected construction staking / surveying include: Three site Bench Marks, Finish Floor Elevation, Rough centerline and perimeter for topsoil strip/ clearance, utility extensions (water and hydrant, sanitary service, storm sewer system with Detention area), light pole locations, parking lot, drives, curb, sidewalk, building corners (rough and pinned).

The expected site construction material and density testing include: Sand (Parking, drives, floor areas), Stone (Parking and drive areas), Asphalt (Parking and drive areas), Concrete (Floor, sidewalks).
- C. The Engineer (MLR Engineering) will perform site inspections, tests, and other site services specified in individual specification Sections and as required by the Owner.
- D. Reports will be submitted by the Engineer (MLR Engineering) to the General Contractor / CM, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with the Engineer, Professional and the Owner; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.
 - 1. Notify Engineer and Professional two (2) working days prior to expected time for operations requiring services.
 - 2. Make arrangements with Engineer and Professional and pay for additional samples and tests required for Contractor's use.
- F. Retesting required because of non-conformance to specified requirements shall be performed by the same Engineer and Professional on instructions by the Owner. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum/Price.

END OF SECTION

SECTION 02110

SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Remove surface debris.
- B. Remove paving, curbs, sidewalks.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Topsoil excavation.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Site Clearing:
 - 1. Basis of Measurement: Included in the unit price bid for utility installation.
 - 2. Basis of Payment: Clearing site, loading and removing waste materials from site, applying herbicide to designated plant life, and removing & disposing of trees & stumps.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for disposal of debris.
- B. Coordinate clearing Work with utility companies.

PART 2 EXECUTION

2.1 PREPARATION

- A. Verify that existing plant life designated to remain, is tagged or identified.

2.2 PROTECTION

- A. Locate, identify, and protect utilities that remain, from damage.
- B. Protect survey stakes.
- C. Protect trees, plant growth, and features designated to remain, as final landscaping.
- D. Protect benchmarks and existing structures from damage or displacement.

- E. All trees, shrubs, and bushes which are too large to be replaced in kind, shall be left undisturbed, with the utility being installed in a boring and/or tunneling operation, unless written consent from the property owner to remove the tree is obtained.
- F. The boring or tunneling operation shall be constructed in accordance with these specifications.
- G. The Contractor shall locate the boring or tunneling pit at a sufficient distance to ensure no damage will occur to the tree.

2.3 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove paving, curbs, sidewalks.
- C. Remove trees as specified on drawing. Remove tree stumps.
- D. Clear undergrowth and deadwood, without disturbing subsoil.

2.4 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Trees, shrubs, and bushes which are removed, and which are to be replaced, shall be done so by an established nursery.
- C. This work shall be included in the unit price for cleanup of the project.
- D. Trees, shrubs, and bushes to be removed shall be done by falling the tree in sections, beginning from the top down and removing the stump and debris from the site.
- E. The property owner, at his option, may elect to claim the usable timber.
- F. If so, the Contractor shall be responsible for cutting the tree into manageable lengths and stockpiling same along the line of the work.
- G. If the property owner does not want the timber, it shall become the property of the Contractor.
- H. The cost of removing trees, brush, and bushes and the cutting of timber and removing debris from the site shall be included in the unit price for cleanup of the project.

2.5 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, marked areas. Farm areas in the project route are to have topsoil windrowed and protected from contamination from sub soil excavation, so it may be replaced and used for farming operations. This is considered part of utility installation.
- B. Stockpile in area designated on site as approved by the Engineer. Protect from erosion.

END OF SECTION

SECTION 02225

MINOR DEMOLITION FOR REMODELING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolishing designated building equipment and fixtures.
2. Demolishing designated construction.
3. Cutting and alterations for completion of the Work.
4. Removing designated items for reuse.
5. Protecting items designated to remain.
6. Removing demolished materials.

1.2 SUBMITTALS

A. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

B. Shop Drawings:

1. Indicate demolition sequence.
2. Indicate location of items designated for reuse.
3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, subsurface obstructions.

1.4 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.6 SCHEDULING

A. Schedule Work to coincide with new construction.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owner's operation in adjoining spaces.

- C. Coordinate utility and building service interruptions with Owner.
 - 1. Do not disable or disrupt building fire or life safety systems without prior written notice to Owner.
 - 2. Schedule tie-ins to existing systems to minimize disruption.
 - 3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.7 PROJECT CONDITIONS

- A. Conduct demolition to minimize interference with adjacent and occupied building areas.
- B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer.
Do not resume operations until directed.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 PREPARATION

- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Mark location and termination of utilities.
- E. Erect, and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.
- F. Erect and maintain weatherproof closures for exterior openings.
- G. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.
- H. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.
- I. Provide appropriate temporary signage including signage for exit or building egress.
- J. Do not close or obstruct building egress path.
- K. Do not disable or disrupt building fire or life safety systems without prior written notice to Owner.

3.2 SALVAGE REQUIREMENTS

- A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.
- B. Tag components and equipment Owner designates for salvage.
- C. Protect designated salvage items from demolition operations until items can be removed.
- D. Carefully remove building components and equipment indicated to be salvaged.
- E. Disassemble as required to permit removal from building.
- F. Package small and loose parts to avoid loss.
- G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.
- H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions to protective envelope and securely attach to each disassembled salvaged item.
- I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

- A. Conduct demolition to minimize interference with adjacent (and occupied) building areas.
- B. Maintain protected egress from and access to adjacent existing buildings at all times.
- C. Cease operations immediately when structure appears to be in danger and notify Architect / Engineer.
- D. Disconnect and remove designated utilities within demolition areas.
- E. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.
- F. Demolish in orderly and careful manner. Protect existing improvements, supporting structural members.
- G. Carefully remove building components indicated to be reused.
 - 1. Disassemble components as required to permit removal.
 - 2. Package small and loose parts to avoid loss.
 - 3. Mark components and packaged parts to permit reinstallation.
 - 4. Store components, protected from construction operations, until reinstalled.

- H. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- I. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- J. Remove temporary Work.

END OF SECTION

SECTION 02274

SOIL EROSION PREVENTION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. System Description.
- B. Quality Assurance.
- C. Regulatory Requirements.
- D. Method of Payment.

1.2 SYSTEM DESCRIPTION

- A. Methods of control are identified on Drawings by numbers corresponding to the Michigan Unified Keying System for soil erosion and sedimentation control.
- B. The notation "T" or "P" following the number (as shown on the Drawings) indicates whether the control measure is temporary or permanent.
- C. Additional control measures shall be employed as required by site conditions and applicable enforcing agency having project jurisdiction.

1.3 UNIT PRICE - BASIS OF MEASUREMENT

- A. Soil Erosion and Sedimentation Control:
 - 1. Basis of Measurement: Included in the unit price for utility installation and cleanup.
 - 2. Basis of Payment: Includes all labor, material, and equipment required for soil erosion prevention and sedimentation control required for this project.

1.4 QUALITY ASSURANCE

- A. Perform and maintain work in accordance with the Soil Erosion and Sedimentation Control, Part 91 of Act 451 of 1994, and corresponding rules of the Michigan Department of Environmental Quality.

1.5 REGULATORY REQUIREMENTS

- A. Contractor shall obtain all permits and pay all fees for plan review and inspection as required by applicable enforcing agency having jurisdiction.

- B. Submit installation time schedule for temporary and permanent soil erosion and sedimentation control measures to applicable enforcing agency having jurisdiction, as well as to Engineer. Make submittals prior to start of construction.
- C. If the site disturbs more than 5.0 acres during the construction project, the Contractor shall obtain a NPDES storm water construction permit and abide by all the rules associated to such a permit.

1.6 METHOD OF PAYMENT

- A. All fees required by applicable enforcing agency shall be paid as stated in Proposal.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Permanent Measures: In accordance with applicable Section for specified materials.
- B. Temporary Measures: In accordance with standards and specifications for soil erosion and sediment control with approved plans and requirements of applicable enforcing agency.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Field locate known utility locations. Notify Engineer of conflicts and attain removal or relocation instructions prior to continuing installation activities.
- C. Maintain and protect existing utilities to remain.

3.2 PROTECTION OF ADJACENT WORK

- A. Protect adjacent structures and property which may be damaged by execution of work.
- B. Protect existing trees, shrubs, landscaping and lawn areas designated to remain.

3.3 INSTALLATION AND MAINTENANCE

- A. Construct soil erosion and sedimentation control measures in accordance with approved plans and requirements of applicable enforcing agency.
- B. Schedule planned control measures with construction operations to limit the area of any disturbed land to the shortest possible period of exposure.

- C. Conduct all earth changes so as to effectively reduce accelerated soil erosion and resulting sedimentation.
- D. Remove all sediment from runoff water before it leaves the site.
- E. Inspect, maintain and repair temporary control measures until permanent control measures are implemented.
- F. Maintain permanent control measures until final acceptance by Owner.
- G. Install silt fences around all catch-basin inlets, to be removed after final inspection of the project.

END OF SECTION

SECTION 2300

EARTHWORK

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes site grading, removal of topsoil and subsoil, building excavating and trenching, backfilling, and compacting.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Michigan Department of Transportation standards.

PART 2 – PRODUCTS

1.3 SOIL MATERIALS

- A. Topsoil: Reusable excavated friable loam; free of subsoil, roots, grass, weeds, free of stone larger than 1/4-inch, foreign matter and capable of supporting, sustaining and rigorous growth of plant life and grass.
- B. Subsoil: Excavated material, graded free of lumps larger than 6 inches, rocks larger than 3 inches, organic material, and debris.

1.4 FILL MATERIALS

- A. Type A - Select Granular Material: Coarse select granular: Coarse stone washed natural stone; free of shale, clay, friable material, sand, debris, equal to "stonemix".
 - 1. Grading:
 - a. Minimum Size: 2 inch.
 - b. Maximum Size: 2 inch.
- B. Type B - Pea Gravel: Natural stone; washed, free of clay, shale and organic matter.
 - 1. Minimum Size: 1/4 inch.
 - 2. Maximum Size: 5/8 inch.
- C. Type C - Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter meeting the requirements of MDOT granular material Class II.
- D. Type D – Subsoil: Reused, free of rock larger than 3 inch size, and debris.

PART 3 -- EXECUTION

1.5 EXAMINATION AND PREPARATION

- A. Call Miss Dig at 1-800-482-7171 not less than 3 working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours and datum.
- C. Notify Architect/Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- D. The Various construction operations shall be restricted to the existing right-of-way or the areas indicated on the Plans. If the CONTRACTOR requires additional area, the CONTRACTOR shall furnish the ENGINEER with written permission obtained from the property owner for any part of the operations he conducts outside of the right-of-way or limits indicated.
- E. Existing Improvements. The CONTRACTOR shall expose existing sewers and structures to which the new Work is to be connected and notify the ENGINEER of same. The ENGINEER will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new Work with the existing system.
- F. Existing Utilities. When existing utilities are shown on the Plans, their locations are approximate only, as secured in the field investigation and/or from available public records. The CONTRACTOR, prior to the start of construction, shall contact Miss Dig and the public agency or utility having jurisdiction to request the verification of all utilities within the construction area.

When existing utility lines, structures or utility poles are encountered during the performance of the Work, the CONTRACTOR, at his expense, shall perform his operations in such a manner that the service will be uninterrupted.

The CONTRACTOR shall expose all existing utility lines prior to any excavation operation, to determine any conflict with the proposed improvement. The CONTRACTOR shall be responsible for any relocation required as a result of any conflict of existing utilities shown on the plans, with the proposed improvement.

Should it become necessary to move any utility structure, line or pole shown on the Plans or otherwise found necessary to be moved, the CONTRACTOR shall make all arrangements with the OWNER of the utility for the moving. All costs incurred for such moving shall be at the CONTRACTOR's expense unless indicated otherwise. However, before disturbing a utility line, structure or pole, the CONTRACTOR shall furnish the ENGINEER with satisfactory evidence, in writing, that proper arrangements have been made with the Owner of the utility.

- G. Utility Poles. The CONTRACTOR shall be responsible for any removal or relocation required as a result of any conflict of existing utility poles (including street light poles, guy poles, telephone poles, etc.) with proposed improvements.

The CONTRACTOR shall make all arrangements for removing or relocating utility poles with the owner of the utility pole.

Prior to disturbing any utility pole, the CONTRACTOR shall provide the ENGINEER with written evidence that proper arrangements have been made with the owner of the utility pole.

When required by the Work, CONTRACTOR shall temporarily support poles in the vicinity of the Work at no additional cost to the OWNER. Support shall be in accordance with and to the satisfaction of the utility company.

- H. Existing Sewers, Tile, and Mains. Existing sanitary sewers, storm sewer, drain tile, septic tank bed tiles, water mains or building services or leads, that are encountered during the performance of the Work that require relocation or are damaged, shall be restored with new materials equal in quality and type to the materials encountered.

The new material shall be installed as specified in the Contract Documents and per the requirements of the local agencies. The bedding and backfill material, unless otherwise specified, shall be an approved Class II granular material, compacted to 95% of its maximum unit weight.

Seepage bed tile and water mains shall be replaced in accordance with the requirement of the agency having jurisdiction.

The relocation or protection of existing sewers, tiles, tile field, water mains or building services and leads shall be at the CONTRACTOR's expense, unless otherwise indicated in the Contract Documents.

- I. Existing Structures. Existing surface and subsurface structures may be shown on the Plans, in locations considered most probable from information secured in the field investigation or from available public records. Neither the correctness nor completeness of such information is guaranteed or implied. All structures shall be protected, preserved or restored by the CONTRACTOR, to the satisfaction of the structure owner, at no additional cost to the Project.

1.6 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water run-off into excavation or to adjacent properties.

1.7 TOPSOIL EXCAVATING

- A. Do not excavate wet topsoil.
- B. Excavate topsoil and stockpile in area designated on site.

1.8 SUBSOIL EXCAVATING

- A. Do not remove wet subsoil.
- B. Remove groundwater by pumping to keep excavations dry.
- C. Excavate subsoil required for building foundations, construction operations, and other Work.
- D. Slope banks to angle of repose or less, until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.

- F. Proof roll bearing surfaces. Fill soft spots with Type "C" fill and compact uniformly to 95 percent of maximum density.
- G. Correct unauthorized excavation at no cost to Owner.
- H. Fill over-excavated areas under structure bearing surfaces in accordance with direction by Architect/Engineer.
- I. Stockpile subsoil in area designated on site.

1.9 TRENCHING

- A. Excavate for storms sewer, sanitary sewer, water and gas piping to municipal utilities.
- B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.
- C. Hand trim excavation and leave free of loose matter.
- D. Support pipe and conduit during placement and compaction of bedding fill.
- E. Backfill trenches to required contours and elevations.
- F. Place and compact fill materials as for Backfilling.

1.10 BACKFILLING

- A. Backfill areas to contours and elevations. Use unfrozen and unsaturated materials.
- B. Backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place geotextile fabric over unstable subsoil.
- D. Place material in continuous layers as follows:
 - 1. Soil Materials: Maximum 12 inches compacted depth.
 - 2. Fill Materials: Maximum 8 inches compacted depth.
- E. Employ placement method so not to disturb or damage foundations, foundation perimeter drainage, foundation waterproofing and protective cover, or utilities in trenches.
- F. Maintain optimum moisture content of backfill materials to attain required compaction density.
- G. Backfill against supported foundation walls. Backfill simultaneously on each side of unsupported foundation walls.
- H. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

1.11 PLACING TOPSOIL

- A. Place topsoil in areas where seeding & planting is scheduled.
- B. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.
- C. Remove large stone, roots, grass, weeds, debris, and foreign material while spreading.
- D. Lightly compact placed topsoil.
- E. Leave stockpile area and site clean and raked, ready to receive landscaping.

1.12 TESTS

- A. Perform laboratory material tests in accordance with ASTM D698.
- B. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922.
- C. Frequency of Tests: Six.

1.13 TOLERANCES

- A. Top Surface of Exposed Subgrade: Plus or minus one inch.
- B. Top of Topsoil: Plus or minus ½ inch.

1.14 SCHEDULE

- A. Interior Slab-On-Grade: Type A fill, 4 inches thick, compact uniformly to 95 percent of maximum density; with cover of Type C fill, 4 inches thick, compact uniformly to 95 percent of maximum density.
- B. Exterior Side of Foundation Walls and Retaining Walls over Granular Filter Material and Foundation Perimeter Drainage: Type C fill to subgrade elevation, compact uniformly to 90 percent. Provide Type B fill at foundation drainage 18" minimum compacted depth.
- C. Fill Under Landscaped Areas: Type D fill, to 12 inches below finish grade, compact uniformly to 90 percent of maximum density. Topsoil fill to grade compacted to 90 percent.
- D. Fill Under Concrete Paving: Type C fill, to 4 inches below finish paving elevation, compact uniformly to 95 percent of maximum density.
- E. Fill under Flexible Pavement: by Pavement Contractor.

END OF SECTION

SECTION 02660
WATER DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Hydrants.
- D. Water Main Installation.
- E. Water Services.

1.2 GENERAL

- A. The work to be done under this Contract consist of the construction of water main with appurtenances.
- B. The Contractor shall furnish all labor, tools, equipment and materials, except as noted herein, required for the construction as shown on the plans or called for in the specifications.
- C. The Owner will not furnish miscellaneous materials such as sand, concrete, or similar items required for water main construction.
- D. Any Contractor not completing the project by the completion date shall preclude himself from bidding any other projects with the Owner.
- E. Working hours for the purpose of pipe installation and any excavation work shall be from 7:00 a.m. until 6:00 p.m., Monday through Friday. Cleanup will be allowed outside of these hours.

1.3 REFERENCES

- A. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- B. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.
- C. ASTM B88 - Seamless Copper Water Tube.
- D. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- E. AWWA C500 - Gate Valves for Water and Sewerage Systems.
- F. AWWA C502 - Dry-Barrel Fire Hydrants.

- G. AWWA C509 - Resilient Seated Gate Valves for Water and Sewerage Systems.
 - H. AWWA C651 - Disinfecting Water Mains.
 - I. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water Distribution.
 - J. NSF 14 - Plastic Piping System Components and Related Materials.
 - K. NSF61 – Drinking Water System Components
 - L. ASTM D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - L. ASTM A126 - Gray Iron Casting for Valves, Flange and Pipe Fittings.
 - M. AWWA C105 - Polyethylene Easement for Ductile Iron Pipe Systems.
 - N. AWWA C111- Rubber Gasket Joints for Ductile Iron Pressure Fittings.
 - O. AWWA C151 - Ductile Iron Pipe, Centrifugally Cast for Water.
 - P. AWWA C153- Ductile Iron Compact fittings, 3 inch through 24 inch and 54 inch through 64 inches for water service.
 - Q. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - R. AWWA C909 – Molecularly Oriented polyvinyl chloride (PVCO) pressure pipe, 4 inch through 24 inches (100mm through 600mm), for water distribution.
- 1.4 SUBMITTALS
- A. Product Data: Provide data on pipe materials, pipe fittings, and accessories not furnished by the Township. Provide manufacturers catalog information.
- 1.5 PROJECT RECORD DOCUMENTS
- A. Record actual locations of valves.
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- 1.7 QUALITY ASSURANCE
- A. Valves: Manufacturer's name and pressure rating marked on valve body.
 - B. Pipe: Marked according to AWWA and NSF Standards.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years' experience.

1.9 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with Municipality standards.

1.10 CONTROL OF VALVES AND HYDRANTS

- A. Possess in tool inventory, the proper valve and hydrant wrenches.
- B. Use of pipe wrench, monkey wrench, or open-end type wrench is prohibited on valves and hydrants.
- C. Shut off and turn on hydrants and valves in accordance with the following regulations and instructions.
 - 1. Only Owner shall turn valves on existing water.
 - 2. If turning a valve on or off will affect service to private property, notice shall be given to those affected before the shut off.
 - 3. Procedure for notifying property owners will be as directed by the Owner.
 - 4. Date, time, and duration will be written on the notice.
 - 5. Repair or replace valves and hydrants damaged during Contractor usage.

PART 2 PRODUCTS

2.1 WATER MAIN PIPE

- A. PVC Pipe: AWWA C900 or C909 SDR 18, NSF approved markings, MDEQ approved.
 - 1. Fittings: Gray or Ductile Iron; AWWA C153 and C104.
 - 2. Joints for Fittings: Mechanical or Push-on with rubber gasket; AWWA C111.
 - 3. Joints for Pipe: Push-on with elastomeric gasket; ASTM D3139 and ASTM F477.
 - 4. Standard Pipe Lengths: 20 feet with a maximum of 15 percent random lengths not less than 10 feet.
- B. Ductile Iron Pipe: Class 52, AWWA 151.
 - 1. Fittings: Gray or Ductile Iron, AWWA C153 and C104.
 - 2. Joint for Pipe: Push-on Mechanical Joint with a compressed nitrile gasket as the seal such as Bell-Tite, Tylon.
 - 3. Joints for Fittings: Push-on type or Mechanical Joint with nitrile gasket; ASTM D-3139 and ASTM F-477.
 - 4. Standard Pipe Lengths: 20 feet with a maximum of 15 percent random lengths not less than 15 feet.

2.3 WATER SERVICE PIPING AND APPURTENANCES

- A. Copper Tubing: ASTM B88, Type K, annealed. Minimum 3/4-inch diameter.

1. Fittings: ASME B16.26, cast bronze.
2. Joints Flared.

B. Saddles, couplings, adapters, corporations, etc. shall be Mueller Co.

2.3 GATE VALVES

- A. Manufacturers
1. Mueller
 2. EJIW

B. Up to and including 12 inches: AWWA C509, iron body, bronze trim, non-rising stem, single wedge, resilient seat, mechanical joints.

C. Two-inch operating nut for key operation, painted red to show right hand open.

D. "Right hand open" in accordance with municipality standards and indicated by an arrow cast on the operating nut skirt. (Open "right"-clockwise)

E. All stainless-steel nuts & bolts.

F. Valves 16" and greater shall be equipped with Bevel gear.

2.4 HYDRANTS

- A. Manufacturers
1. EJIW 5BR.

B. AWWA C502, for 150-pound working pressure, compression-type, opening with the line pressure, mechanical joints.

C. Bronze mounted throughout with no iron to iron or steel contacts or threads.

D. Operating stem in base and valve seat shall be bronze.

E. Iron parts of high strength grey iron conforming ASTM Designation A-126 Class B.

F. 5 1/4-inch valve opening for hydrants with a 6-inch mechanical joint inlet.

G. Minimum inside barrel dimension of 8 inches.

H. Completely assembled at factory with drain opening sealed with threaded plug.

I. Two fire hose connections and one pumper connection in accordance with Municipal standards.

J. Hydrant shall open "Right" (Clockwise) in accordance with Municipal standards and shall be plainly marked with an arrow near the operating nut showing the opening direction. 3/4" square operating nut.

- K. Provide proper length for installation in a trench depth of 6'-0" or as indicated on the drawings. Install hydrant to grade according to "bury line" marked on the hydrant assembly. Adjust hydrant to proper grade as necessary. Mounding dirt around hydrant will not be an acceptable means of achieving proper grade.
- L. Tested to 300 pounds hydrostatic pressure from inlet side with valve in both open and closed position.
- M. Painted above the grade line a color in conformance with the municipal standards and black below.
- N. Designed so one man can easily remove or replace the working parts without removing the main valve seat.

2.5 TAPPING SLEEVES AND VALVES

- A. Manufacturers
 - 1. Mueller
 - 2. Romac
 - 3. Or approved equal
- B. Tapping valve shall be as specified in paragraph 2.3 Gate Valves.

2.6 VALVE BOXES

- A. Manufacturers
 - 1. Mueller
 - 2. EJIW
 - 3. Bibby
 - 4. Or approved equal
- B. Cast Iron 5 1/2-inch diameter, three-piece adjustable screw type, for installation of a 6-foot trench.
- C. Valve box extensions for trench depths greater than 6'-6".
- D. No. 6 round base for gate valves up to 8".
- E. No. 160 oval base for valves 10" and greater.
- F. Drop covers marked "water".

2.7 CORPORATION STOPS AND SADDLES

- A. Manufacturers
 - 1. Mueller
- B. Single strap saddles for 3/4 inch and 1 inch and double strap saddles for 1 1/2 inch and 2-inch services.

- C. Threads compatible with Municipal standards.
- D. Corporations stops in accordance with Municipal standards.

2.8 CURB STOP BOX

- A. Mueller
- B. Cast Iron body, 2" I.D. of upper section, one-piece lid.
- C. Extension type with Arch pattern base.
- D. Foot piece required for 1 ½" or larger curb stop.
- E. Mueller H10314 5'6" depth bury 48" stainless steel rod with pin.

2.9 CORROSION PROTECTIVE MATERIAL

- A. Coatings: To be applied to buried nuts, bolts, threaded rod and flanges, including those used for flanged, mechanical and restrained joints.
 - 1. Manufacturers:
 - a. San Chem, Inc., 1600 South Canal Street, Chicago, Illinois 60616.
Product: NO-OXG-GG-2
 - b. Coronado Paint Product: Coal Tar Epoxy, 10 mil (DMT)
 - c. Or equal.
- B. Polyethylene Encasement: ANSI/AWWA C105/A21.5, 8 mil linear low-density polyethylene film or 4 mil high-density, cross-laminated polyethylene film. Encasement to be wrapped around all ductile iron pipe, fittings, valves, and hydrants to within one foot of finish grade. Secure wrap in place according to manufactures instructions.

2.10 BLOWOFF

- A. The Contractor shall furnish and install a blowoff on the end of the water main as shown on the plan or as directed by the Engineer.
- B. The blowoff shall include furnishing and installing the tapped plug, curb stop and box, copper pipe of sufficient length to extend to the existing ground elevation and any necessary adaptor fittings required.

2.11 JOINT RESTRAINT

- A. Manufacturer: MEGALUG by EBBA Iron.
 - 1. Series 1100 for mechanical joints restraints on ductile iron pipe.
 - 2. Series 1700 for push joint/bell restraints on ductile iron pipe.
 - 3. Series 2000 PV for mechanical joint restraints on PVC pipe.
 - 4. Series 1600 for push joint/ bell restraints on PVC pipe.
- B. Restrain all mechanical joints with retainer glands. Restrain all joints within length (s) according to restraint schedule.

- C. Restrain hydrants, tees, valves etc. according to manufacturer's requirements for application soil type, trench detail, test pressure of 150 psi, safety factor of 2 and depth of bury.
- D. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraint mechanism shall consist of plurality of individually actuated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80.

The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest version. Twist off nuts, sized same as tee-head bolts, shall be used to insure proper actuating of restraining devices.

The restraining glands shall have a pressure rating equal to that of the pipe on which it is used. The restraining glands shall have been tested to ASTM F1674-96, be listed by Underwriters Laboratories, and be approved by Factory Mutual. The restraint shall be MegaLug as manufactured by EBBA iron or approved equal.

- E. Ductile iron pipe restraint shall consist of a wedge action restraint ring on the spigot joined to a ductile iron follower gland behind that bell. The restraint ring shall have individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The restraint ring and its wedging components shall be made of a minimum grade of 60-42-10 ductile iron conforming to ASTM A536. The wedges shall be heat-treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to insure proper actuation of the restraining wedges. The follower gland shall be made of a minimum grade of 60-42-10 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure, with a minimum two to one safety factor, of 350 psi in sizes sixteen inch and below and 250 psi in the sized eighteen inch through thirty-six inch. The product shall be the Series 1700 MegaLug restraint harness manufactured by EBBA Iron or approved equal.
- F. Restraint for PVC pipe bell (AWWA C900) shall consist of the following. The restraint shall be manufactured of ductile iron conforming to ASTM A536. A split ring shall be utilized behind the pipe bell. A serrated ring shall be used to grip the pipe and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring. The combination shall have a minimum working pressure rating of 150 psi. The restraint shall be approved by Factory Mutual. The restraint shall be the Series 1600 as manufactured by EBBA Iron, Inc. or approved equal.
- G. Submit to Engineer in accordance with Section 1300 – Submittals, product information and restraint schedule showing locations of use.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry and not over-excavated.

3.2 PREPARATION

- A. Hand trim trench excavation to required elevations. Correct over excavation with compacted MDOT 6A crushed limestone at no additional cost.
- B. Remove large stones or other hard matter which could damage pipe.

3.3 WATER MAIN CROSSING WATERCOURSES

- A. Water mains crossing County drains shall be made in dry trench conditions and shall conform to the requirements of the Public Works Commissioner.

3.4 CONNECTION TO EXISTING WATER MAIN

- A. The Contractor shall connect the proposed water main to the existing water main as shown on the plans or as directed by the Engineer.
- B. The Contractor shall locate the existing water main prior to construction of the proposed water main and shall furnish and install the necessary fittings, including tees, bends, crosses, cutting-in-sleeves, pipe and/or adaptors as necessary to complete the connection.
- C. The Contractor shall be paid for the linear feet of water main installed at his bid price necessary to accomplish the connection.

3.5 CROSSING EXISTING UTILITIES

- A. Where gas mains and services, water mains and services, sewers or any underground utilities cross the trench in open cut, compacted sand backfill shall be required to bed the crossing line.
- B. The sand backfill shall extend to 4 inches above the top of the pipe or conduit which is being supported.
- C. In addition to the sand backfill it may be necessary to support the pipe crossing the trench with a 6"x6" timber with ends supported on solid earth at both sides of the trench.
- D. When supporting pipes with collars or bell joints, the timber shall be placed 3" below such collars or bells and the barrel of the pipe supported with hardwood blocking at 3-foot centers.
- E. The cost of sand backfill used for supporting cross trench piping and the timber supports shall be considered incidental to the project.

3.6 BACKFILLING TRENCH NOT REQUIRING COMPLETE SAND BACKFILL

- A. As soon as the backfill has been brought to the original surface, the material in the trench shall be saturated with water by the method known as spiking, whereby water is forced into the backfill material through a 1" or larger nozzle-type pipe pushed into the backfill 3/4 of the distance from the surface of the ground to the top of the pipe and allowing water to run until it appears at the surface, other than around the nozzle.
- B. This should be repeated at 6'-to-10' intervals along the trench, depending upon the character of the soil.
- C. After saturation, the fill should be allowed to dry out before the backfilling is completed.
- D. Should a deficiency in the backfilling occur, in either quantity or quality of excavated materials taken from the trench, the Contractor shall supply the deficiency without extra charge to the Owner.
- E. No foreign nor perishable material shall be used in the backfilling.

3.7 DISPOSAL OF FLUSHING WATER

- A. The Contractor shall provide outlets to existing drainage for flushing purposes.

3.8 WATER COST

- A. The Contractor shall pay for all water used during construction, including water main breaks and water necessary for testing, cleaning, and chlorinating water mains.
- B. The actual volume of water used shall be determined by the Engineer.
- C. The rate of pay for all water used shall be at the current rate per 1,000 gallons.
- D. The water necessary to fill the volume of the water main at the completion of the project shall be paid by the Owner.

3.9 MAINTAINING WATER SERVICE

- A. The Contractor shall coordinate any proposed interruptions in the existing water system with both the Owner and Engineer.
- B. If any portions of the existing water mains cannot remain in service due to construction of the proposed water mains, the Contractor shall extend a temporary 1-1/4" polyethylene service to each customer affected by the outage.
- C. The cost of these temporary connections, if required, shall be included in all other items of the Contract.
- D. Services shall be reconnected to the existing water main.

3.10 JOINTING

- A. Mechanical Joints:
 - 1. Make joints in accordance with manufacturer's instructions.
- B. Push-on Joints:
 - 1. Make joints in accordance with manufacturer's instructions.
- C. Flanged Joints:
 - 1. Make joints in accordance with manufacturer's instructions.

3.11 INSTALLATION - PIPE, FITTINGS AND ACCESSORIES

- A. Install pipe, fittings and accessories in accordance with manufacturer's instructions.
- B. Install to the line and elevations shown on the drawings.
- C. Water Main shall have a minimum cover of 5'-6" from proposed finish grade. Unless shown otherwise on the drawings or directed by the Engineer.
- D. After the trench or tunnel has been graded, place a minimum 4 inches of compacted Type B, material, as specified in Section 02223 - Backfilling in the trench as a bed for the pipe.
- E. Hand trim for bell and spigot pipe joints.
- F. Carefully lay the pipe on the bedding to insure positive bearing along the full length of the pipe.
- G. Place 4 inches tamped Type B fill along the side of the pipe, filling any void space under the pipe. Execute tamping with a T bar or other tamping device approved by the Engineer.
- H. Place additional tamped Type B fill alongside the pipe to a height equal to the top of the pipe.
- I. Place and compact Type B fill material to 12 inches above the top of the pipe.
- J. Restrain pipe and fittings as detailed on the drawings, or as described in the specifications.

3.12 POLYETHYLENE ENCASEMENT

- A. Install in accordance with manufacturer's instructions and AWWA C105.
- B. Install to prevent contact between ductile iron pipe, fittings, valves and hydrants and the surrounding backfill and bedding material.
- C. Encasement is not intended to be a completely air tight nor water tight enclosure.

- D. Overlap joints a minimum of 18 inches and secure with adhesive tape or plastic string for the purpose of holding polyethylene in place until backfilling operations are complete.
- E. Encase valves up to the operating nut without interfering with valve operation.
- F. Encase hydrants to the grade line.
- G. Repair rips, punctures and other damage with adhesive tape or with a piece of polyethylene secured in place.

3.13 INSTALLATION - HYDRANTS

- A. Install in accordance with manufacturer's instructions.
- B. Set at plan location and grade as directed by the Engineer.
- C. Set on concrete block with minimum dimensions of 4 inches by 8 inches by 16 inches.
- D. Restrain as detailed on the plans.
- E. Set plumb.
- F. Rotate up to 180 degrees to face the direction shown on the plans.
- G. Set only when the Engineer is present.
- H. Obtain approval of the Engineer prior to backfilling.
- I. Backfill according to Section 02225 - Trenching: Backfilling.

3.14 INSTALLATION - VALVES

- A. Install in accordance with manufacturer's instructions.
- B. Tighten nuts on valve body.
- C. Set plumb on a 4" x 8" x 16" concrete block. Use larger blocks for larger valves.
- D. Backfill with Type A material to a minimum of 2 inches above the flange of the valve dome.
- E. Leave valves in the open position except for the valves that connect to the existing water main.

3.15 INSTALLATION - VALVE BOXES

- A. Set base on Type A material a minimum of 2 inches above the flange on the valve dome and centered over the operating nut. Backfill to finish subgrade according to Section 02225 - Trenching: Backfilling.

- B. Set box plumb and centered over the valve operating nut.
- C. Adjust the top of the valve box to match proposed finish grade.
- D. Install extensions for trench depth greater than 6'-10".

3.16 INSTALLATION - TAPPING SLEEVES AND VALVES

- A. Install in accordance with manufacturer's instructions.
- B. Install valve in accordance with provisions of paragraph 3.14, INSTALLATION - VALVES.

3.17 WATER SERVICE CONNECTIONS

- A. Work shall include all material for complete operation.
- B. This work shall not begin until the proposed main has been tested, disinfected, accepted by the Engineer and is in operation.
- C. Services shall pass visual inspection by the Engineer, under system pressure prior to backfilling.
- D. Backfill according to Section 02225 - Trenching: Backfilling.

3.18 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Section 01400 - Quality Control. Public Water Main will require full time inspection, staking, and testing by the Engineer, MLR Engineering, 134 S. Main Street, Suite 1, Freeland, MI (989-239-2384

3.19 TESTING

- A. Pressure Leakage Test
 - 1. Perform Hydrostatic pressure test per AWWA C605.
 - 2. Perform after entire water main or a section between two valves has been installed and has passed the visual leakage test.
 - 3. Each section of pipe between two valves shall be pressure tested. If the Contractor elects to test a longer distance of pipe, the shortest length between two valves shall be used for allowable leakage calculation. Contractor must then verify all gate valves are working properly.
 - 4. Lines shall be filled slowly with potable water at a maximum velocity of 1 ft/sec (0.3 m/sec) while venting air. Precautions shall be taken to prevent entrapping air in the lines. After filling, lines shall be flushed at blowoffs and dead ends at a minimum velocity of 3 ft/sec (0.9 m/sec). A minimum of three changes of treated water shall be used in flushing operations.

5. Pressurize pipe to 125 psi and maintain for one half hour.
6. Reduce pressure to 100 psi and maintain for two hours.
7. Test Allowance: The testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi (34 kPa) of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the formula:

$$Q = (LD\sqrt{P}) / 148,000$$
 Where: Q=quantity of makeup water, in gallons per hour
 L= length of pipe section being tested, in feet.
 D= nominal diameter of pipe, in inches
 P= gauge test pressure, in psi
8. Read line pressure on a 4-inch diameter gauge with snubber and a range of 0 to 200 psi in 2 psi increments as manufactured by Wika Instrument Corporation, or equal.
9. Measure water added to the pipe with a tested water meter connected to the water supply line.
10. For short sections of pipe, water may be added through a sterilized container and the amount calculated by direct measurement.
11. Find and repair leaks.
12. Flush pipe with potable water.

B. Visual Leakage Test

1. When directed by the Engineer, a visual leakage test may be performed in lieu of a pressure leakage test.
2. Place sufficient backfill to prevent pipe from buckling or shifting.
3. Joints remain exposed.
4. Restraints are installed.
5. Place and block test plug at the end of the pipe.
6. Fill pipe slowly with water expelling all air.
7. Increase water pressure to equal pressure from existing supply water main.
8. Visually inspect joints for leakage.
9. Repair leaks and repeat test.
10. Backfill after successful completion of test.

A. DISINFECTION

- A. Verify that water main is complete, flushed, and clean.
- B. Inject disinfectant, chlorine solution, through a corporation cock inserted in the horizontal axis of the water main.
- C. Inject at the beginning of the pipeline or a valved section.
- D. Slowly fill the line with potable water from the existing distribution line.
- E. Bleed water from a valve at the end of the line to ensure distribution and prevent pressure build up in excess of 20 psi.
- F. Inject disinfectant, chlorine solution, to obtain a concentration of 40 to 50 parts per million.

- G. Chlorine residual may be checked with N,N-diethyl-p-phenylenediamine (DPD), 40 to 50 parts per million solution will produce a deep red color.
- H. Maintain disinfectant in pipeline for 24 hours.
- I. Flush disinfectant from pipeline. Contractor shall be responsible for dechlorinating flushing water to local, state, or federal requirements.
- J. Verify disinfectant removal with DPD reagent.
- K. Engineer, with assistance from the Contractor, will obtain samples for laboratory tests, a minimum of 24 hours after flushing the disinfectant from the pipeline, in accordance with AWWA requirements.
- L. For New water main, sets of samples shall be collected every 1200 feet (370m) of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.
- M. Do not place water main into service until laboratory tests show satisfactory results in accordance with Michigan Department of Environmental Quality standards for safe drinking water.
- N. Repeat the complete disinfecting process if laboratory results deem the water unsafe for drinking.
- O. Replace corporation cocks with brass plugs when the disinfecting process is complete, and water is determined safe for drinking.
- P. The use of chlorine pills or tablets placed in the pipe during construction to be used in the disinfecting process is prohibited.

**PIPE RESTRAINT SCHEDULE FOR
GROUND BURIED PRESSURE PIPES ^{1 2}**

LENGTH OF RESTRAINT REQUIRED ³

Deflection Angle	22 1/2	33 3/4	45	56 1/4	67 1/2	78 3/4	90, tee or dead end
Pipe							
6"	8	12	16	20	25	31	59
8"	10	15	20	26	33	40	77
10"	12	18	25	32	40	49	93
12"	14	21	29	37	47	57	109
14"	16	24	33	41	54	66	125
16"	18	27	37	47	60	74	141
18"	20	30	41	53	67	82	157
20"	22	33	45	58	73	90	172
24"	25	39	53	68	85	105	202
30"	30	46	63	82	102	126	244
36"	35	54	74	95	119	146	283
42"	40	61	83	107	133	164	320
48"	44	67	92	118	148	181	356

END OF SECTION

¹ This table is based on a test pressure of 150 PSI (Operating pressure + water hammer). For other test pressures, all values shall be increased or decreased proportionally.

² Table is valid for depths of bury 5 feet or greater. For depths of bury less than 5 feet, consult D.I.P.R.A. guidelines.

³ In each direction from point of deflection or termination, except for tee at which only the branch in the direction of the tee stem.

SECTION 02722
STORM SEWERAGE SYSTEM

PART GENERAL

1.1 SECTION INCLUDES

- A. Storm sewerage drainage piping, fittings and accessories, excavation and bedding.
- B. Connection of drainage system to municipal sewers.
- C. Manholes and Catch basins.
- D. Detention/Retention basins.

1.2 REFERENCES

- A. AASHTO M36 - Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.
- B. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- C. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- D. ASTM C12 - Practice for Installing Vitrified Clay Pipelines.
- E. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- F. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- G. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
- H. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- I. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- J. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12-inch (304.8 mm) Drop.
- K. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.
- L. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- M. ASTM D2729 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

- N. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- O. ASTM D3033 - Type PSP Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- P. ASTM D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- Q. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- R. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- S. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.3 SUBMITTALS FOR REVIEW

- A. Product Data: Provide data indicating pipe, pipe accessories, and manhole and catch-basins castings.

1.4 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Accurately record actual locations of pipe runs, connections, catch basins and invert elevations.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Vitrified Clay Pipe: ASTM C700, Extra strength.
- B. Concrete Pipe: ASTM C14, Class 1, 2 and 3; unreinforced; inside nominal diameter of 8-15 inches tongue and groove end joints.
- C. Reinforced Concrete Pipe: ASTM C76, Class I, II, III, IV and V as called for on the plans; inside nominal diameter of 18-84 inches tongue and groove end joints.
- D. Plastic Pipe: ASTM D3024, SDR-35, polyvinyl chloride (PVC) material; inside nominal diameter of 10 inches rubber gasketed joint end.
- E. Plastic Pipe: ASTM D3350 and AASHTO M294 as supplied by ADS or Hancor Inc.

2.2 ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Filter Fabric: Non-biodegradable, woven, manufactured by Mirafi, Amaoco, or approved equal.
- C. Grout: Specified in Section 04065.

2.3 CATCH BASINS & ACCESSORIES

- A. Lid and Frame: Cast iron construction, manufactured by EJIW or approved equal.
 - 1. Lid Design: As specified on the plans.
- B. Shaft Construction and Concentric Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints, nominal shaft diameter of 36 inches.
- C. Base Pad: Precast concrete of type specified in Section 03050.

2.4 BEDDING AND COVER MATERIALS

- A. Bedding: In accordance with Standard Details Plan. B. Cover: In accordance with Standard Details Plan.

2.5 MANHOLES AND ACCESSORIES

- A. Barrell and conical top section.
 - 1. Reinforced, precast concrete pipe section conforming to ASTM C-478.
 - 2. Nominal diameter of 48 inches or as indicated on the drawings.
 - 3. Pre-cast reinforced concrete base.
 - 4. Plastic coated steel steps at 15 inches on center.

2.6 MANHOLE COVERS AND FRAMES

- A. Or indicated on the plans.
- B. Or equal.
- C. Manhole frame shall have 4 holes in the base flange for bolting to cone section.
- D. Furnish 4 inch by 5.8-inch cadmium coated threaded studs with nuts and washers for bolting frame to cone section.
- E. Manholes shall be adjusted to grade using grade rings with rubber gaskets.

2.7 MORTAR FOR MANHOLES

- A. Mix mortar per ASTM C270, utilizing the Proportion Method to achieve 2,500 psi 28-day strength.
- B. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.
- C. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of the mortar.
- E. If water is lost by evaporation, retemper only within two hours of mixing.
- F. Use mortar within two hours after mixing at temperatures of 80 degrees F, or two-and-one-half hours at temperatures under 50 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on the drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with sand or aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321.
- B. Place pipe on minimum 4-inch-deep bed of filter aggregate.
- C. Lay pipe to slope gradients noted on drawings.
- D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent.
- E. Refer to Section 02300 for trenching requirements. Do not displace or damage pipe when compacting.

3.5 INSTALLATION - CATCH BASINS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe.
- C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- D. Establish elevations and pipe inverts for inlets and outlets as indicated.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

- A. Section 01400 - Quality Assurance: Field inspection and testing.
- B. Request inspection prior to placing any storm sewer or structure.
- C. Compaction testing will be performed in accordance with ASTM D1557.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Tests: Per 12" lift per 250 LF minimum.

3.7 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.8 INSTALLATION - MANHOLES

- A. Install according to manufacturer's instructions.
- B. Trim bottom of excavation clean and smooth to correct elevation.
- C. Install precast bases on 6 inches of Type A fill.
- D. Form and place reinforced concrete base to correct elevation.
- E. Install stubs and branch connections as indicated.
- F. Bed stubs and branch connections with Type A fill.
- G. Install barrel sections, cone section, and frame and cover to required grade.
- H. Maximum height from top of cone to bottom of frame shall be 18 inches.
- I. Bolt frames to cones.
- J. Cover frame with mortar from cone to within 1-1/2 inches of top of frame.

END OF SECTION

SECTION 02732
SANITARY SEWER

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Extension of municipal sanitary sewerage drainage piping, fittings, accessories and bedding.
- B. Manholes.

1.2 REFERENCES

- A. ANSI/ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- B. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
- C. ANSI/ASTM D3034 - Type PSM (Poly Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D. ANSI/ASTM F1417 – Plastic Pipe Air Testing.
- E. ANSI/ASTM C828 – Vitrified Clay Pipe Air Testing.

1.3 DEFINITIONS

- A. Bedding: Fill placed under, beside and 12" directly over pipe, prior to subsequent backfill operations.

1.4 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories, and manholes frames & covers.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record location of pipe runs, connections, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for materials and installation of the Work of this section.

1.7 COORDINATION

- A. Coordinate the Work with termination of sanitary sewer connection at the property line.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Plastic Pipe: ANSI/ASTM D3034, SDR 35, Type PSM, (PolyVinyl Chloride) (PVC) material; inside nominal diameter of 6, 8, 10 and 12 inches, rubber gasket joints. (Sewers 19' deep or less.) Joints shall meet ASTM D3212.
- B. Plastic Pipe: ANSI/ASTM D2241, SDR 26 Type PSM (Poly Vinyl Chloride) (PVC) material; inside nominal diameter of 6, 8, 10, 12 and 15 inches, rubber gasket joints. (Sewers deeper than 19'.) Joints shall meet ASTM D3139.
- C. Ductile Iron Pipe: AWWA C150 and C151, Class 52, cement lined. Joints shall be gasketed push on or compression fitting suitable for D.I. Pipe and for gravity sewer application.

2.2 PIPE ACCESSORIES

- A. Fittings and Branch Connections: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, wyes, cleanouts, reducers, traps and other configurations required.

2.3 MANHOLES AND ACCESSORIES

- A. All manholes shall have wye directional changes inside the structure. No 'T's will be allowed.
- B. All manhole flow channels shall utilize the sanitary sewer thru the structure.
- C. Barrel and conical top section.
 - 1. Reinforced, precast concrete pipe section conforming to ASTM C478.
 - 2. Nominal diameter of 48 inches or as indicated on the drawings.
 - 3. Pre-cast reinforced concrete base.
 - 4. Plastic coated steel steps at 15 inches on center.
 - 5. O-ring rubber gasket premium type joints.
 - 6. 1/2-inch diameter galvanized pipe nipple with cap through the manhole wall at an elevation equal to the top of the pipe. Nipple shall extend 3 inches into the manhole.
 - 7. Connect main line to manholes utilizing a flexible neoprene gasket with stainless steel band.
 - Kor-N-Seal, by National Pollution Control Systems, Inc.
 - Model Ps10, by Press Seal Gasket Corp.
 - A-Lok, by A-Lok Products, Inc.
 - Or approved equal.

2.4 MANHOLE COVERS AND FRAMES

- A. As indicated on the plans.
- B. Or equal.
- C. Manhole frame shall have 4 holes in the base flange for bolting to cone section.
- D. Furnish 4 inch by 5/8-inch cadmium coated threaded studs with nuts and washers for bolting frame to cone section.
- E. Manholes shall be adjusted to grade using grade rings with 3/4" butyl rope or rubber gaskets.

2.5 BEDDING MATERIALS

- A. PVC Pipe: Type A Fill to top of pipe and Type B Fill to 12 inches above top of pipe.
- B. D.I. Pipe: Type B to 12 inches above top of pipe.
- C. Filter Fabric: Place filter fabric over Type A Fill for the complete width of the trench.

2.6 MORTAR FOR MANHOLES

- A. Mix mortar per ASTM C270, utilizing the Proportion Method to achieve 2,500 psi 28 day strength.
- B. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.
- C. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, retemper only within two hours of mixing.
- F. Use mortar within two hours after mixing at temperatures of 80 degrees F, or two-and-one-half hours at temperatures under 50 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with Type A fill.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
 - a. BEDDING
 - i. Excavate pipe trench - Trenching for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
 - ii. Dig out for pipe bells.
 - iii. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.
 - iv. Maintain optimum moisture content of bedding material to attain required compaction density.
 - b. INSTALLATION - PIPE
 - i. Install pipe, fittings, and accessories in accordance with ASTM C12 for rigid pipe and ASTM D2321 for flexible pipe and manufacturer's instructions. Seal joints watertight.
 - ii. Lay pipe to the line and grade indicated on the drawings by the use of a laser beam alignment method proven reliable and operated by competent experienced personnel.
 - iii. P.V.C. Pipe Bedding
 - 1. Install bedding material MDOT 6A compacted crushed limestone to a depth of 1/4 of the outside pipe diameter, but not less than 4" under the pipe barrel.
 - 2. Bring first lift of MDOT 6A compacted crushed limestone halfway up the side of the pipe and compact with mechanical tamping tools.
 - 3. Bring next lift of MDOT 6A compacted crushed limestone to the top of the pipe and compact.
 - 4. Place filter fabric over second lift of bedding material through the roadways or areas receiving complete sand backfill.
 - 5. Third lift of compacted granular material (sand) shall extend 12" above the top of the pipe.
 - iv. D.I. Pipe Bedding
 - 1. Install bedding material granular material to a depth of 1/4 of the outside pipe diameter, but not less than 4" under the pipe barrel.
 - 2. Bring first lift halfway up the side of the side of the pipe and compact with mechanical tamping tools.
 - 3. Bring next lift to the top of the pipe and compact.
 - 4. Third lift of compacted granular material (sand) shall extend 12" above the top of the pipe.

- v. Refer to Section 02225 - Trenching for backfilling requirements. Do not displace or damage pipe when compacting.
 - vi. Connect to municipal sewer system.
- c. INSTALLATION - BRANCH CONNECTIONS OR SERVICES
- i. Install according to manufacturer's instructions.
 - ii. Install the size indicated on the drawings.
 - iii. Install at locations indicated on the drawings or as directed by the Engineer.
 - iv. Install according to the details on the drawings.
 - v. Place plugs in connections which will not have pipe connected to them immediately. Plugs shall withstand the pressures of air testing.
 - vi. Lay branch connections and services lying within the trench on 1300 psi concrete from the bottom of the trench to the spring line of the pipe with a thickness equal to 6" greater than the diameter of the pipe.
 - vii. Verify inverts of proposed services.
- d. INSTALLATION - MANHOLES
- i. Install according to manufacturer's instructions.
 - ii. Trim bottom of excavation clean and smooth to correct elevation.
 - iii. Install precast bases on 6 inches of Type A fill.
 - iv. Form and place reinforced concrete base to correct elevation.
 - v. Install stubs connections as indicated. Service leads are not allowed in manholes.
 - vi. Bed stubs and branch connections with Type A fill.
 - vii. Install barrel sections, cone section, and frame and cover to required finish landscape grade.
 - viii. Maximum height from top of cone to bottom of frame shall be 18 inches.
 - ix. Bolt frames to cones.
 - x. Cover frame with mortar from cone to within 1 1/2 inches of top of frame.
 - xi. Adjusting rings will be limited to no more than two on any individual manhole.

e. INFILTRATION TESTING

- i. All sewers and manholes shall be subject to an infiltration test.
- ii. Maximum infiltration for P.V.C. and D.I. pipe shall be 50 gallons per inch of pipe diameter per mile of pipe per day.
- iii. Length of sewer to be tested at one time shall not exceed 1500 feet.
- iv. Ground water level at the time of the test shall be a minimum 2 feet above the top of the pipe or Contractor shall saturate trench.
- v. Repair sections of sewer that exceed the infiltration limit.

f. AIR TESTING

- i. Test sewers 24 inches in diameter and smaller in accordance with ASTM F1417 for PVC pipe and ASTM C828 for vitrified clay pipe.
- ii. Furnish Owner with acceptable air test results for each 1000 feet segment prior to further testing.
- iii. Test in increments between manholes.
- iv. Clean and plug pipe at each manhole.
- v. Plugs shall be designed to hold against the test pressure and provide an airtight seal.
- vi. One plug shall have an orifice through which air can be pumped into the sewer.
- vii. An air supply line fitted with control valves and a pressure gage to measure the air pressure in the pipe shall be connected to the orifice.
- viii. The air pressure gage shall have a minimum diameter of 3 1/2 inches, a range of 0 - 10 psig, increments of 0.10 psig and accuracy of ± 0.04 psig.
- ix. Check water level over pipe by connecting a clear plastic tube to the 1/2-inch pipe nipple in each manhole.
- x. Increase test pressure by 0.433 psig for each foot of ground water above the top of the pipe.
- xi. Pressurize the sewer pipe to 4 psig greater than the greatest back pressure caused by ground water over top of the sewer pipe.
- xii. Allow two minutes for air pressure to stabilize between 3.5 and 4.0 psig.
- xiii. Add air to the pipe to begin the test at a pressure between 3.5 and 4.0 psig.
- xiv. Close valve at the end of the stabilization period so that no more air enters the pipe.

- xv. Record the gage pressure and begin timing for the test.
- xvi. Test will not begin if pressure is less than 3.5 psig or greater if required to compensate for ground water pressure.
- xvii. The time required for the air pressure to decrease 0.5 psig for PVC pipe during the test shall not be less than the time shown in the following table.
- xviii. Repair and retest failed sections.
- xix. Follow safety procedures.
 - 1. Block plugs securely.
 - 2. Relieve air pressure completely before removing plugs.
 - 3. A 15" plug with 4.5 psig applied exerts almost 800 pounds of force.

PVC PIPE SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015											
1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Min. Time (ft.)	4 Time for Longer Length (sec)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:48	4:26	5:04	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

g. DEFLECTION TEST

- i. Test PVC sewer for deflection by a deflectometer or the "Go-No-Go" nine-point mandrel method.
- ii. Perform deflection test no sooner than 30 days after completion of backfilling.
- iii. Re-excavate trench in areas where deflection exceeds 5%.
 1. Remove and replace pipe and bedding where pipe is damaged.
 2. Remove and replace bedding where pipe is not damaged.
- iv. Retest pipe for deflection no sooner than 30 days after replacement of backfill.
- v. Refer to page 279 of the "Handbook of the PVC Pipe, Design and Construction", published by the Uni-Bell Plastic Pipe Association for determination of the base inside pipe diameters for deflection testing.
- vi. Refer to the following chart for base inside diameters for the classes of pipe specified.

SIZE	DR35	DR26	SERIES 46
8"	7.76	7.79	00.00
10"	9.71	9.71	00.00
12"	11.56	11.52	00.00
18"	00.00	16.61	17.65
24"	00.00	22.15	23.65

- vii. Provide testing equipment.

h. CLEANING

- i. Clean and flush the sewer when installation and testing is complete.

i. INTERNAL TELEVISION INSPECTION

- i. The Contractor will employ the services of a company specializing in the videotaping services to provide an internal television inspection of the sewers installed under this contract.
- ii. Contractor shall clean the sewers and manholes prior to internal inspection.
- iii. Provide access to the sewers for the internal inspection.
- iv. Correct deficiencies made apparent by the internal inspection prior to final acceptance of the project.

j. FIELD QUALITY CONTROL

- i. Field inspection and testing will be performed under provisions of Section 01400 - Quality Control. Public Sanitary Sewer will require full time inspection, staking, and testing by the Engineer, MLR Engineering, 134 S. Main Street, Suite 1, Freeland, MI (989-239-2384).
- ii. Request inspection prior to beginning work.
- iii. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- iv. Frequency of Tests: As directed by the Engineer.
- v. Pressure Test: Test in accordance with Paragraph 3.8.
- vi. Infiltration Test: Test in accordance with Paragraph 3.7.
- vii. Deflection Test: Test in accordance with Paragraph 3.9.
- viii. Internal Television Test in accordance with Paragraph 3.11

k. PROTECTION

- i. Protect finished installation under provisions of Section 01500 - Construction Facilities and Temporary Controls.
- ii. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02740
FLEXIBLE PAVEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate subbase.
 - 2. Asphalt paving base course, leveling course, and wearing course.
 - 3. Pavement markings.

1.2 PERFORMANCE REQUIREMENTS

- A. Paving: Designed for parking and light duty commercial and semi-truck vehicles.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit product information for asphalt and aggregate materials.
 - 2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

- A. Mixing Plant: Conform to State of Michigan Department of Transportation standards.
- B. Obtain materials from same source throughout.
- C. Perform Work in accordance with State of Michigan Department of Transportation standards.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 degrees F below bitumen suppliers bill of lading and not more than maximum specified temperature.
- C. Pavement Marking Paint: Clean and dry surfaces, cured 21 days minimum, at a minimum ambient surface temperature of 40 degrees F for oil based and not exceeding 95 degrees F.

PART 2 – PRODUCTS

2.1 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M320; performance grade PG 64-22.
- B. Asphalt Cement: ASTM D946; penetration grade 40-50.
- C. Oil: In accordance with State of Michigan Department of Transportation standards.
- D. Coarse Aggregate: ASTM D692.
 - 1. Course Stone, 100% crushed limestone meeting 22A and free of shale, frost susceptibility, clay, friable material, sand and debris, equal to Stonemix.
- E. Base Course Mix: In accordance with State of Michigan Department of Transportation, 2012 Edition Standards, Bituminous 3C performance, Grade 64-22.
- F. Leveling Course Mix: In accordance with State of Michigan Department of Transportation, 2012 Edition Standards. Bituminous 13A performance, Grade 64-22.
- G. Wearing Course Mix: In accordance with State of Michigan Department of Transportation, 2012 Edition Standards, Bituminous 13A performance, Grade 64-22.
- H. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling full depth removal of existing asphalt paving, limited to 30 percent of asphalt base course and 17 percent of asphalt wearing course.
- I. Fine Aggregate: ASTM D1073; natural sand or sand manufactured from stone or gravel.
- J. Primer: Homogeneous, medium curing liquid asphalt in accordance with State Standards.
- K. Mineral Filler: ASTM D242; finely ground mineral particles, free of foreign matter.

2.2 ACCESSORIES

- A. Sealant: ASTM D6690, Type II or Type III; hot applied type.
- B. Pavement Marking Paint: Alkyd resin type, ready mixed, complying with PS-TT-P-115 Type I or equal.
- C. Surface Sealer: Pre-approved product shall be Seal Master Coal Tar Concentrate Pavement Sealer and Master Seal Concentrate asphalt-based pavement sealer at a one-to-one mixture or as approved by Engineer/Architect.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify gradients and elevations of base.
- B. Verify compacted subgrade subbase is dry and ready to support paving and imposed loads.

3.2 SUBBASE

- A. Aggregate Subbase: Install as specified in Section 02300.
- B. Prepare subbase in accordance with State of Michigan Department of Transportation standards.

3.3 PRIMER

- A. Apply primer on aggregate subbase at uniform rate of 1/3-gal/sq. yd.
- B. Use clean sand to blot excess primer.

3.4 TACK COAT

- A. Apply tack coat on asphalt and concrete surfaces over subgrade surface at uniform rate.
 - 1. New Surfaces: 1/3-gal/sq. yd.
 - 2. Existing Surfaces: 1/2-gal/sq. yd.
- B. Apply tack coat to contact surfaces of curbs and gutters.
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.

3.5 DOUBLE COURSE ASPHALT PAVING

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place binder course to thickness identified in schedule at end of section.
- C. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- D. Place wearing course to thickness indicated on Drawings.
- E. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- G. Paint 4" wide pavement markings: Allow pavement to cure 30 days before marking, sweep clean to eliminate loose material and dust, apply at a uniform rate with straight edges to a uniform thickness, minimum 15 mils.
 - 1. Caution Yellow at standard parking stalls.
 - 2. Blue at Barrier Free parking stalls.

3.6 ERECTION TOLERANCES

- A. Flatness: Maximum variation of 1/4-inch measured with 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4-inch.
- C. Variation from Indicated Elevation: Within 1/2-inch.

3.7 FIELD QUALITY CONTROL

- A. Take samples and perform tests in accordance with AI MS-2.
- B. Take samples and perform tests including mat density tests.
- C. Asphalt Paving Mix Temperature: Measure temperature at time of placement.
- D. Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1000 square yards compacted paving.
- E. Asphalt Paving Density: ASTM D2950 nuclear method; test one location for every 1000 square yards compacted paving.

END OF SECTION

SECTION 02750
RIGID PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways, Roadways and Pavements.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
 - 5. Equipment pads.
 - 6. Dumpster pads.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete pavement mixture.

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. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.

- F. 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."

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I or II.
 - a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4M coarse aggregate, uniformly graded. Provide aggregates from a single source. Use only non-reactive aggregate. Maximum Aggregate Particle Size: 1 inch nominal.
- C. Water: ASTM C 94.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: ASTM C 494, 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.

2.3 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 BASF Sonneborn, "Kure-N-Seal" Curing Compound: Apply 2 coats. ASTM C 309, Type 1, Class B, dissipating.

2.4 RELATED MATERIALS

- A. Expansion-Joint Filler Strips: Polyethylene closed-cell backing for Sonolastic Sealants.
- B. Isolation- and Control -Joint Filler Strips: Closed -cell Backer-Rod and Soft Backer-Rod. ASTM C 1330, Type B and C.
- C. 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.

2.5 CONCRETE MIXTURES

- A. Prepare and Submit 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.
 - 4. Air Content: 6 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.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
- B. The Owner will employ qualified testing lab to take and test, concrete cylinder samples.
- C. Any concrete failing the compressive strength tests will be removed and replaced at the Contractor's expense.

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.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. 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.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- B. Chairs are required for support of all reinforcing steel. Manual pull up and positioning of reinforcing steel during concrete pouring is unacceptable.

3.4 JOINTS

- A. 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.
- 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.
- 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.
- 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.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a $\frac{1}{4}$ inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. 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.
- D. Screed pavement surfaces with a straightedge and strike off.
- E. 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.

3.6 FLOAT 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-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.7 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 curing compound.

3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: ¼ inch.
 2. Thickness: Plus 3/8 inch, minus ¼ inch.
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed ¼ inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus ¼ inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.9 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

SECTION 02811
LANDSCAPE IRRIGATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, sleeves and fittings.
 - 2. Valves.
 - 3. Outlets and accessories.
 - 4. Control system.

1.2 SYSTEM DESCRIPTION

- A. Extend and modify existing electric solenoid controlled underground irrigation system, with pressure blow-out drain.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, controller, plant and landscaping features, site structures, schedule of fittings to be used.
- B. Product Data: Submit component and control system and wiring diagrams.

1.4 MAINTENANCE SERVICE

- A. Furnish manufacturer's maintenance services on equipment and accessory items for one year from Date of Substantial Completion.
- B. Include system seasonal start-up and shut-down, outlet adjustment, control testing, and replacement of worn or damaged components.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Pipe: PVC in accordance with ASTM D2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent-weld sockets.
- B. Pipe: ABS in accordance with ASTM D2282; 160 psi pressure rated upstream from controls, 100 psi downstream; solvent-weld sockets.
- C. Pipe: ASTM B88 Type K Drawn Temper, copper; solder joints.
- D. Fittings: Type and style of connection to match pipe.
- E. Solvent Cement: ASTM D2564 for PVC pipe and fittings and ASTM D2235 for ABS pipe and fittings.
- F. Solder and Flux: ASTM B32 Type 95TA solder; paste flux.

- G. Outlets: Plastic/PVC construction.
 - 1. Rotary Type Sprinkler Head: Pop-up type with screens; fully adjustable for flow and pressure; size as indicated on Drawings; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.
 - 2. Spray Type Sprinkler Head: Pop-Up head with pattern as required.

2.2 VALVES

- A. Gate Valves: Bronze construction, non-rising stem, inside screw with threaded ends.
- B. Backflow Preventers: Bronze body construction, double check valve type.
- C. Valve Box and Cover: Plastic.

2.3 CONTROLS

- A. Controller: Automatic controller, microprocessor solid state control with visible readout display, temporary override feature to bypass cycle for inclement weather, timer for multiple station system, programmable for 7 days in quarter hour increments, with automatic start and shutdown.
- B. Controller Housing: Weatherproof, watertight, with lockable access door.
- C. Electric solenoid Valve: Normally closed, to control wiring, including required fittings and accessories.
- D. Wire: Color coded. Copper conductor, direct burial type.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify field conditions and location of existing utilities are acceptable.
- B. Piping layout indicated is diagrammatic only. Route piping to avoid plants and structures.

3.2 INSTALLATION

- A. Trench in accordance with Section 02300.
- B. Install pipe, valves, controls, and outlets.
- C. Slope pipe to drain.
- D. Set sprinkler heads and box covers at finish grade elevations.
- E. Install control wiring and conduit. Bury wire conduit beside pipe. Set valve markers in pipe risers exiting from top of valve to finish grade.
- F. Adjust control system to achieve time cycles required.

3.3 BACKFILLING

- A. Prior to backfilling, test system for leakage for whole system to maintain 100 psi pressure for one hour. System is acceptable when no leakage or loss of pressure occurs during test period.
- B. Install 3-inch sand cover over piping. Backfill trench and compact to subgrade elevation as specified in Section 02300.

3.4 SCHEDULES

- A. Perimeter of Grassed Areas: Pop-Up half circle heads.
- B. Corners of Grassed Areas: Pop-Up quarter circle heads.
- C. Within Grassed Areas: Pop-Up full circle heads.
- D. Planters: Fixed square pattern head, and one emitter for each 4 sq. ft of planter area.

END OF SECTION

SECTION 02820
FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY:

- A. Section includes vinyl fencing and gate systems.

1.2 REFERENCES:

- A. American Society for Testing and Materials (ASTM):
1. ASTM D256 Standard Test Methods for Determining Izod Pendulum Impact Resistance of Plastics.
 2. ASTM D638 Standard Test Method for Tensile Properties of Plastics.
 3. ASTM D648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
 4. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 5. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 6. ASTM D4216 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds.
 7. ASTM F964 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Exterior Profiles Used for Fencing.

1.3 DEFINITIONS

- A. Posts: Vertical structure supports members of the fence/gate system.
- B. Rails: Horizontal structural support members of the fence/gate system.
- C. Pickets: Vertical members between the bottom and top rails.
- D. Aluminum Channel: Structural supports inside rails.
- E. Galvanized Steel Channel: Structural supports inside rails.

1.4 SYSTEM DESCRIPTION:

- A. The contractor shall provide a complete PVC fencing/gate system of the design, style, and strength defined herein. Fencing and gate components are comprised of profiles made of extruded, rigid polyvinylchloride (PVC). This PVC material is specially formulated for outdoor use with superior color hold and impact resistant properties after extended outdoor exposure. The system shall include all posts, rails, pickets, caps, metal inserts, and accessory items necessary to complete the installation.

1.5 SUBMITTALS:

- A. General: Submit listed submittals in accordance with the Conditions of the Contract.
- B. Product Data: Submit product data for specified products.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, accessories, and finish colors. Include details showing fabrication and installation of rails and pickets, including plans, elevations, sections, detail of components, and attachments to other units of work, if required.
- D. Samples: Submit selection and verification of samples for finishes, colors, and profiles if requested.
- E. Quality Assurance Submittals: Submit the following:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties. Include copies of selected test reports by independent laboratories verifying the compliance of fencing components and systems with applicable building codes upon request.
 - 2. Compliance Reports: Research reports or evaluation reports of the model code organization acceptable to authorities having jurisdiction. Provide evidence that the polyvinyl chloride fencing systems are in compliance with applicable building code in effect for project.
 - 3. Certificates: Product certificates signed by the manufacturer certifying that materials comply with specified performance characteristics and criteria and physical requirements.
 - 4. Manufacturer's installation instructions
 - 5. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
- F. Closeout Submittals: Submit the following:
 - 1. Operation and Maintenance Data: Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
 - 2. Warranty: Warranty documents to finishes and performance.

1.6 QUALITY ASSURANCE:

- A. Qualifications:
 - 1. Polyvinyl Chloride Fencing Fabricator/Installer Qualifications: Engage a Ply Gem Fence & Railing licensed fabricator to ensure successful completion of project.
 - 2. Obtain PVC fence accessories, fittings and fasteners from Ply Gem Fence & Railing approved source to ensure consistent quality standards are maintained throughout the project.
 - a. Certificate: When requested, submit certificate indicating qualifications.
 - 3. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving installer and application methods.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. General: Comply with Division 1 Product Requirements Sections:
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection: Store materials protected from exposure to material handling damage and accumulation of dirt and grime, at temperature and humidity conditions recommended by manufacturer. Handle and store product according to manufacturer's recommendations. Store in original packaging whenever possible until components on the project.

1.8 PROJECT CONDITIONS:

- A. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY:

- A. Project Warranty: Refer to Conditions of the Contract for project warrant provisions used with their permission. The manufacturer is responsible for technical accuracy.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation, of, other rights Owner may have under Contract Documents.

PART 2 – PRODUCTS

2.1 PVC FENCING AND GATE SYSTEMS

- A. Manufacturer: Ply Gem Fence & Railing or Equal>
 - 1. Contact: 521 W. 26th Street, York, NE 68467
Telephone: (402) 363-6100
Fax: (402) 363-6191
 - 2. Contact: 15159 Andrew Jackson Highway, 76 W. Fair Bluff, NC 28439
Telephone: (910) 649-7501
Fax: (910) 649-7371

- B. Proprietary Product(s)/System(s): Ply Gen PVC Fencing Systems
1. Post Profile Types and Sizes: As indicated on drawings and as follows:
 - a. 5" x 5" x 0.154" wall.
 2. Rails Profile Types and Sizes: As indicated on drawings and as follows:
 - a. 1-1/2" x 5-1/2".
 3. Pickets Profile Types and Sizes: As indicated on drawings and as follows:
 - a. 7/8" x 6" tongue and groove (T&G).
 4. Caps Profile Types and Sizes: As indicated on drawings and as follows:
 - a. Post Cap Styles and Sizes:
 1. Pyramid: 5" x 5"
 - b. Rail Cap Styles and Sizes:
 1. Flat: 1-1/2" x 5-1/2"
 - c. Picket Cap Styles and Sizes:
 1. Flat: 1" x 4" rectangular
 5. Aluminum Reinforcements Types and Sizes: As indicated on drawings and as follows:
 - a. 3" flat ribbed insert for 1" x 3-1/2" cap rail.
 - b. H-channel for 3" x 3" open rail.
 - c. I-channel for 1-1/2" x 5-1/2" slotted rail.
 6. Finishes: Smooth, soft gloss.
 7. Colors: Titanium dioxide is the main ultraviolet light inhibitor in the PVC material used to manufacture these products. Since it is a white pigment, dark colors are not practical or possible. Decorative cap rails are available with a selection of architectural accent colors. Three Woodland Select™ colors are available for the 1" x 8" tongue and groove pickets which include Natural Cedar, Weathered Cedar, and Redwood.
 - a. Rails: White, tan, sandstone, or khaki (2" x 3-1/2" x 0.130" and 2" x 6-1/2" slotted rails available in Weathered Cedar.
 - b. Posts: White, tan sandstone, or khaki (4" x 4" x 0.160" and 5" x 5" x 0.154" post available in Weathered Cedar.
 - c. Pickets: Weathered Cedar (1" x 8" T&G only).
 - d. Post and Rail caps: contact Ply Gem Fence & Fencing dealer for color availability.
 8. French Gate Components: As indicated on drawings and as follows:
 - a. Latch Assembly: 1-1/2" x 2-3/4"
 - b. Hinge Assembly: 1-1/2" x 2-3/4"
 - c. Pop rivets.
 - d. Pocket assembly (for attaching horizontal structural members to vertical structural members) 1-1/2" x 5-1/2"
 9. Product(s)/System(s) Testing: Provide PVC fencing system that complies with the following physical/chemical properties:
 - a. ASTM D256 – Izod Impact greater than 5 ft lb./in (2.1 N*m/m) at 23°C.
 - b. ASTM D638 – Tensile Strength 6950 psi (43 MPa).
 - c. ASTM D638 – Tensile Modulus 407,800 psi (2963 MPa).
 - d. ASTM D648 – Deflection Temperature 67°C.

2.2 PRODUCT SUBSTITUTIONS:

- A. Substitutions: Substitutions permitted.

2.3 FABRICATION:

- A. General: Fabricate fencing systems to comply with requirements indicated for design, dimension, details, finish, and member sizes, including wall thickness, but not less than hose required to support structural loads.
 - 1. Fabricated at a licensed dealer and, if practical, pre-assemble fence sections prior to transporting to jobsite or have delivered in the skid-load knock down kits. Fabrication includes, but is not limited to, cutting, routing, and drilling components, in accordance with engineering drawings, specifications or Ply Gem Fence & Railing CAD details for fence sections.
 - 2. Fabricate with galvanized steel or aluminum inserts as necessary.

2.4 SOURCE QUALITY:

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, product carton instructions for installation, or design/detail drawings.

PART 3 – EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, product carton instructions for installation, or design/detail drawings.

3.2 EXAMINATION:

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with that manufacturer's instructions.

3.3 PREPARATION:

- A. All new installation shall be laid out by the contractor in accordance with the consultation plans.

3.4 INSTALLATION:

- A. Depending upon the style of fence being installed, set fence posts on 6' or 8' centers (see individual installation instructions for the appropriate style). Set gate posts for gate opening specified in the construction drawings. Posts shall be placed 24" to 36" in the ground, depending upon the style of fence and local conditions and set in concrete (see individual installation instructions for the appropriate style).
- B. Gate posts and corner posts on all fences and some line posts on taller fences shall be reinforced with either aluminum post insert or cement and two No. 4 rebar members. Concrete should not contact rails to allow for expansion.

- C. Place assembled fence sections into position and slide rails into posts. The rails are secured into posts by tabs, which are notched into the rails and catch on the inside wall of the post. Top rails may be further secured with a #8-4" screw through the rail, inside the post.
- D. Install gates using bolt-on hardware supplied by the manufacturer.

3.5 CLEANING:

- A. Cleaning: remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

SECTION 02900

PLANTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preparation of soil and fertilizer.
 - 2. Placement of plant life.
 - 3. Seeding.

1.2 SUBMITTALS

- A. Product Data: Submit list of plant material sources, data for fertilizer and other accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

1.4 QUALIFICATIONS

- A. Nursery: Company specializing in growing and cultivating plant life specified in this section.
- B. Sod Producer: Company specializing in sod production and harvesting.

1.5 WARRANTY

- A. Furnish one-year warranty including one continuous growing season including coverage of plants from death or unhealthy conditions.
- B. Replacements: Plants of same size and species as specified, planted in next growing season, with new warranty beginning on date of replacement.

1.6 MAINTENANCE SERVICE

- A. Maintain seeded areas, sodded areas and plant life immediately after placement until grass and plants are well established and exhibit vigorous growing condition for two cuttings.

PART 2 PRODUCTS

2.1 GRASS

- A. Sod Seed Mixture:
 - 1. Merion Blue Grass: 35 percent.
 - 2. Kentucky Blue Grass: 45 percent.
 - 3. Creeping Red Fescue Grass: 10 percent.
 - 4. Norlea Perennial Rye: 10 percent.

2.2 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants and Ground Cover: Species and size identified in Plant Schedule as indicated on Drawings, grown in climatic conditions similar to those in locality of the Work.

2.3 SOIL AND SOIL MODIFICATION MATERIALS

- A. Topsoil: Imported and reused.
- B. Fertilizer: Fifty percent of elements derived from organic sources, to the following proportions: Nitrogen 13 percent, phosphoric acid 25 percent, soluble potash 12 percent.
- C. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates. As required to adjust soil pH.

2.4 ACCESSORIES

- A. Decorative Mulching Material: Stone, river washed, clean and free of organic material of the following size:
 - 1. Maximum: 3 inches.
 - 2. Minimum: 1 inch.
- B. Temporary Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- C. Wood Pegs: Softwood, sufficient size and length to anchor sod on slopes.
- D. Edging: Plastic, heavy commercial duty with steel stakes and male/female connectors.
- E. Weed Barrier: 6 mil black vinyl.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify required underground utilities are in proper location.
- B. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Scarify subsoil to depth of 3 inches.

3.2 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 6 inches. Rake smooth.
- B. Grade topsoil to eliminate rough, low or soft areas. Slope for positive drainage.
- C. Place topsoil into pits and beds intended for plant root balls to minimum thickness of 8 inches.
- D. Apply lime at rate recommended by manufacturer.
- E. Apply fertilizer at rate recommended by manufacturer.

3.3 SOD

- A. Machine cut sod and delivery sod within 24 hours of installation.
- B. Test soil for pH and amend as required for pH between 6 and 7.5. A minimum of four tests will be required and perform a minimum of four weeks prior to installation.
- C. Loosen top soil for 4-5 inches and mix fertilizer with top soil. Rake level. Maintaining 1" below grade of sprinkler heads. Moisten soil 24 hours prior to sod installation.
- D. Unroll, lay sod in rows, tight fitting, staggered joints/seams, work to remove air pockets between soil and sod.
- E. Roll sod to eliminate air pockets.
- F. Limit traffic on sod for three weeks or until sod is established.
- G. Water thoroughly new sod and daily for the first week. Second week, water every other day.

3.4 PLANTING

- A. Set plants in pits or beds partly filled with prepared topsoil mixture. Backfill soil mixture.
- B. Saturate soil with water when pit or bed is half full of top soil and again when full.

3.5 MAINTENANCE

- A. Mow grass at regular intervals to maintain maximum height of 2 ½ inches. Do not cut more than 1/3 of grass blade at each mowing.
- B. Water to prevent grass and soil from drying out.
- C. Control growth of weeds.

END OF SECTION

SECTION 03050

BASIC CONCRETE MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Formwork and accessories
 - 2. Reinforcement.
 - 3. Cast-in place concrete.
 - 4. Finishing and curing.

1.2 SYSTEM DESCRIPTION

- A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 301, ACI 318 to conform to applicable code requirements to achieve concrete shape, line and dimension.
- B. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate pertinent dimensioning, form materials, arrangement of joints and ties, location of bracing and temporary supports.
 - 2. Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
 - 3. Indicate sidewalks and slabs-on-grade.
- B. Product Data: Indicate admixtures and anchors.
- C. Design Data: Submit mix designs.

1.4 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301, ACI 318.
- B. Perform concrete reinforcing work in accordance with ACI 301, ACI 315, ACI 318 and CRSI Manual of Practice.
- C. Perform cast-in-place concrete work in accordance with ACI 301, ACI 318 and ACI 305.
- D. Crystalline Manufacturer: Manufacturer to have no less than 10years experience in manufacturing the crystalline waterproofing additive for the required work. Manufacturer must be capable of providing field service representation during construction phase. Manufacturers that cannot provide the performance test data specified herein will not be considered.
- E. Crystalline Admixtures Applicator: Installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.

PART 2 PRODUCTS

2.1 FORM MATERIALS AND ACCESSORIES

- A. Form Materials: At discretion of Contractor.
- B. Plywood: PS 1, C Grade any species; sound undamaged sheets with clean true edges.
- C. Lumber: any species.
- D. Prefabricated Steel Type: Minimum 16 gage, matched, tight fitting, stiffened to support weight of concrete.
- E. Pan Type: Steel; of size and profile required.
- F. Tubular Column Type: Round, spirally wound laminated materials, inside surface treated with release agent, of size required.
- G. Form Ties: Removable or snap-off, metal type of fixed length.
- H. Water stops: PVC, 6-inch-wide, dumbbell type, without center bulb, maximum possible lengths, profiled as required for Project conditions. Equal to DuraJoint #01030138.
- I. Flashing Reglets: Galvanized steel, with alignments splines for joints.
- J. Form Release Agent: Colorless mineral oil not capable of staining concrete or impairing natural bonding characteristics of coating intended for use on concrete.
- K. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile, knockout holes to receive doweling.
- L. Slab Edge Joint Filler: ASTM D1751, 1/2 inch thick.
- M. Vapor Retarder: ASTM E1745 Class A; 6 mil thick clear polyethylene film, type recommended for below grade application. Furnish joint tape recommended by manufacturer.

2.2 REINFORCEMENT MATERIALS

- A. Deformed Reinforcement: ASTM A615/A615M; 60 ksi yield strength, steel bars, unfinished.
- B. Deformed Reinforcement: ASTM A706/A706M; 60 ksi yield strength, steel bars, unfinished.
- C. Welded Plain Wire Fabric: ASTM A185; in flat sheets; unfinished.
- D. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for support of reinforcing; plastic tipped or non-corroding for supports in slabs forming finished ceilings or where supports are exposed to weather.
- E. Fabricate concrete reinforcement in accordance with CRSI Manual of Practice, ACI 301 and ACI 318.
- F. Weld reinforcement in accordance with AWS D1.4.

2.3 CONCRETE MATERIALS

- A. Cement: ASTM C150, Normal-Type I Portland type.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.
- D. Air Entrainment Admixture: ASTM C260.
- E. Bonding Agent: Latex emulsion.
- F. Non-shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

2.4 COMPOUNDS, HARDENERS AND SEALERS

- A. Chemically Reactive Lithium – Silicate Liquid Hardener: Chemisil Plus Li, as manufactured by ChemMasters.
 - 1. At all interior exposed concrete floors.

2.5 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94/C94M, Option A.
- B. Furnish concrete of the following strength:
 - 1. Compressive strength 4500 psi (28 day).
 - 2. Slump 3 to 5 inches.
- C. Select admixture proportions for normal weight concrete in accordance with ACI 318.
- D. Add air entraining agent to concrete mix for concrete work exposed to exterior.

2.6 CRYSTALLINE WATERPROOFING ADMIXTURE

- A. Acceptable Manufacturer:
 - 1. Xypex Chemical Corporation
13731 Mayfield Place
Richmond, B.C., Canada V6V 2G9
Tel: 800-961-4477 or 604-273-5265
- B. Proprietary Products: Xypex crystalline waterproofing materials as follows:
 - 1. Xypex Admix C-500
- C. Substitutions: No substitutions permitted.
- D. Source Quality: Obtain proprietary crystalline waterproofing products from a single manufacturer.
- E. General: Xypex Admix must be added to concrete mix at time of batching.
- F. Dosage Rate: Under normal conditions, the crystalline waterproofing powder shall be

added to the concrete mix at the following rates:

1. Xypex C-500: 2-3% by weight of Portland cement content.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

- A. Erect formwork, shoring and bracing to achieve design requirements.
- B. Camber slabs and framing to achieve ACI 301 tolerances.
- C. Provide bracing to ensure stability of formwork.
- D. Form external corners chamfer as indicated on Drawings.
- E. Apply form release agent to formwork prior to placing form accessories and reinforcement.
- F. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings affected by agent.
- G. Clean forms as erection proceeds, to remove foreign matter.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

- A. Provide formed openings where required for work to be embedded in and passing through concrete members.
- B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
- C. Install concrete accessories straight, level, and plumb.
- D. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.
- E. Place formed construction joint device in floor slab pattern pouring sequence.
- F. Place joint filler at perimeter of floor slab, penetrations, and isolation joints.
- G. Install void forms. Protect forms from moisture before concrete placement and from crushing during concreting.

3.3 REINFORCEMENT PLACEMENT

- A. Place reinforcement supported and secured against displacement.
- B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.
- C. Weld reinforcement in accordance with AWS D1.4.
 1. Do not weld crossing reinforcement bars for assembly.
- D. Space reinforcement bars with minimum clear spacing in accordance with ACI 301, ACI 318.

1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- E. Maintain concrete cover around reinforcement in accordance with ACI 301, ACI 318.

3.4 CYRSTALLINE WATERPROOFING CONCRETE

- A. General: Xypex Admix shall be added to the concrete mix at time of batching. Thorough blending of the Xypex Admix throughout the concrete mix is essential for correct performance of the product and, therefore, care should be taken to ensure that a homogeneous mixture is obtained.
- B. Concrete Batching and Mixing: Procedures for mixing will vary according to type of batch plant operation and equipment.
 1. Ready Mix Plant – Dry Batching Operation: Add Xypex Admix powder to drum of ready-mix truck, then add 60% - 70% of required water along with 300-500 lb. of aggregate. Mix the materials for 2-3 minutes to ensure that the Admix is distributed evenly throughout the mix water. Add balance of materials to the ready-mix truck and mix in accordance with standard batch practices.
- C. General: Concrete containing Xypex Admix shall be most cured in accordance with ACI Reference 308, "Standard Practice for Curing Concrete".
- D. Curing Compounds: Curing compounds may be used in the event that project requirements or conditions prevent moist curing. Curing compounds shall comply with ASTM C-309.
- E. Protection: Protect installed product and finished surfaces from damage during construction.
- F. Examination for Defects: Do not conceal Xypex treated concrete before it has been observed by Architect/Engineer, waterproofing manufacturer's representative, and other designated entities. Concrete shall be examined for structural defects such as faulty construction joints, cold joints, and cracks. Such defects to be repaired in accordance with manufacturer's repair procedures.

3.5 PLACING CONCRETE

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
- B. Install vapor retarder under interior slabs on grade in accordance with ASTM E1643. Lap joints minimum 6 inches and seal watertight.
- C. Repair damaged vapor retarder with vapor retarder material, lap over damaged areas minimum 6 inches and seal watertight.
- D. Separate slabs-on-grade from vertical surfaces with 1/2-inch thick joint filler, extended from bottom of slab to within 1/4 inch of finished slab surface.
- E. Place concrete continuously between predetermined expansion, control, and construction joints.
- F. Place floor slabs in saw cut pattern indicated.

- G. Where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrink grout.
- H. Screed floors, slabs-on-grade, and concrete base for toppings level.

3.6 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Remove formwork progressively and in accordance with code requirements.

3.7 SEPARATE FLOOR TOPPINGS

- A. Place concrete floor toppings to required lines and levels.
- B. Prior to placing, roughen concrete base course and remove deleterious material. Broom and vacuum clean.
- C. Place required reinforcing and other items to be cast in.
- D. Apply bonding agent base course.

3.8 FLOOR FINISHING

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.
- B. Uniformly spread, screed, and float concrete.
- C. Wood float surfaces receiving ceramic tile with full bed setting system.
- D. Steel trowel surfaces receiving carpeting, resilient flooring thin set ceramic tile or remaining exposed to view in finished construction.
- E. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft.
- F. In areas with floor drains, maintain floor level at walls and slope surfaces uniformly to drains.
- G. Apply concrete hardener on floor surfaces.

3.9 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
 - 1. Protect concrete footings from freezing for minimum 5 days.
- B. Apply sealer on floor surfaces. Place absorptive matting, moisten, and keep damp.
- C. Immediately after placement, protect concrete from premature drying.
- D. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete for not less than 7 days.

3.10 FORMED SURFACES

- A. Provide concrete surfaces to be left exposed with smooth rubbed finish.

3.11 ERECTION TOLERANCES

- A. Install reinforcement within tolerances required by ACI 301 and ACI 318.

3.12 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with ACI 301 and ACI 318.
- B. Reinforcement Inspection:
 - 1. Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
- C. Strength Test Samples:
 - 1. Sample concrete and make one set of three cylinders for every 75 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
- D. Field Testing:
 - 1. Measure slump and temperature for each compressive strength concrete sample.
 - 2. Measure air content in air entrained concrete for each compressive strength concrete sample.
- E. Cylinder Compressive Strength Testing:
 - 1. Test Method: ASTM C39.
 - 2. Test Acceptance: In accordance with ACI 301 and ACI 318.
 - 3. Test two cylinders at 28 days.
 - 4. Retain one cylinder for testing when requested by Architect/Engineer.
 - 5. Dispose remaining cylinders when testing is not required.

3.13 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by Architect/Engineer.

END OF SECTION

SECTION 04065
MASONRY MORTAR AND GROUT

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes mortar and grout for masonry.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Portland Cement: ASTM C150, Type I, gray color.
- B. Mortar Aggregate: ASTM C144, standard masonry type.
- C. Hydrated Lime: ASTM C206, Type N.
- D. Grout Aggregate: ASTM C404, fine and coarse.
- E. Water: Clean and potable.
- F. Bonding Agent: Latex type.
- G. Calcium chloride is not permitted.

2.2 MIXES

A. Mortar Mixes:

1. Mortar for Structural Masonry: ASTM C270, Type M using Property specification.
2. Mortar for Non-Structural Masonry: ASTM C270, Type S using Property specification.
3. Pointing Mortar: ASTM C270, Type N, using Property specification.
4. Stain Resistant Pointing Mortar: One-part Portland cement, 1/8-part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

B. Mortar Mixing:

1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.

C. Grout Mixes:

1. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; mixed in accordance with ASTM C476 Fine grout.

D. Grout Mixing:

1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.
2. Do not use anti-freeze compounds to lower freezing point of grout.

PART 3 EXECUTION

3.1 PREPARATION

- #### A.
- Apply bonding agent to existing concrete surfaces.

3.2 INSTALLATION

- #### A.
- Install mortar and grout in accordance with ACI 530.1 Specification for Masonry Structures.

3.3 FIELD QUALITY CONTROL

- #### A.
- Testing Frequency: One set of specified tests for every 5,000 sf of completed wall area.
- #### B.
- Testing of Mortar Mix: In accordance with ASTM C780.
- #### C.
- Testing of Grout Mix: In accordance with ASTM C1019.

END OF SECTION

SECTION 04270
GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 GENERAL

- A. Glass Block Units, hollow or solid
- B. Integral Joint Reinforcement
- C. Mortar

1.2 REFERENCES

- A. ASTM A82-Spec. for Cold Drawn Steel Wire
- B. ASTM A153-Class B-2, Spec. Zinc Coating (Hot dip) on iron and steel hardware (Canada same)
- C. ASTM C144, Spec. for Aggregate for Masonry (Canada - A179-94)
- D. ASTM C150. Spec. for Portland Cement (Canada - CAN/CSA - A5-93)
- E. ASTM E163, Fire Test of Window Assemblies (equivalent to UL® 9 and CAN 4-S106-MS0)
- F. ASTM C207, Spec. for Hydrated Lime for Masonry Purposes (Canada same)
- G. ASTM C270, Spec. for Mortar for Unit Masonry (Canada - A179-94)
- H. ASTM 01187, Type II-Spec. for Asphalt-Base Emulsions (For Metal Surfaces)
- I. ASTM D1227, Type III-Spec. for Emulsified Asphalt (For Porous Surfaces)

1.3 System Description

- A. Knowledge of the following basic information is essential for proper installation of Pittsburgh Corning Glass Block units:
 - a. Glass block panels shall not be designed to support structural loads.
 - b. Maximum deflection of structural members supporting glass block panels shall not exceed L/600.
 - c. Sills of all panels must be painted with a heavy coat of asphalt emulsion and must dry for two hours before first mortar bed is placed.
 - d. Provision for expansion and movement must be made at jambs and heads of all panels. Mortar must not bridge expansion spaces.
 - e. Mortar should be mixed and applied in accordance with the recommendations of Pittsburgh Corning Corporation. See Materials.

1.4 SUBMITTALS

A. Product Data

- i. Submit two (2) copies of manufacturer's literature and two (2) copies of manufacturer's installation instructions.

B. Samples

- i. Submit two (2) glass block units of each type specified showing size, design and pattern of faces.
- ii. Submit representative samples of (panel reinforcing), (panel anchors), (expansion strips), and (sealant).

C. Test Reports

- i. Fire Tests
- ii. Submit documents verifying glass block units are classified for a 3/4, 1 or 1 1/2-hour fire exposure according to ASTM E163, Underwriters Laboratories of Canada CAN 4-S106-M80 or UL® 9 "Fire Tests of Window Assemblies." All such glass block unit cartons shall carry appropriate UL® labels.

1.5 STORAGE AND PROTECTION

A. Store unopened cartons of glass block in a clean, cool, dry area.

B. Protect opened cartons of glass block against windblown rain or water run-off with tarpaulins or plastic covering.

1.6 PROJECT/SITE CONDITIONS

Do not install glass block units when temperature is 40° F (4° C) and falling. Maintain the temperature of glass unit masonry above 40° F (4° C) for the first 48 hours after construction.

1.7 WARRANTY

Pittsburgh Corning Corporation offers a limited 5-year warranty on Pittsburgh Corning Glass Block units. See warranty statement.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The drawings and specifications are based on catalog data, specifications and products of Pittsburgh Corning Corporation and designate the type and quality of work intended under this section.

1. Products of other manufacturers proposed as equivalent quality must be submitted through the bidding contractors for written approval of the architect ten days prior to the bid date.

2. Supporting technical data, samples, published specifications and the like must be submitted for comparison.
3. Contractor shall warrant that proposed substitutions, if accepted, will provide performance equivalent to the materials specified herein.
4. These specifications have been developed by Pittsburgh Corning Corporation based on extensive tests of panels composed of Pittsburgh Corning Glass Block masonry units manufactured by Pittsburgh Corning Corporation. These specifications do not apply to panels made from glass block masonry units produced by any other manufacturer.

2.2 GLASS BLOCK UNITS

- A. Glass block units, nominally 8 inch x 8 inch x 4 inch thick shall be partially evacuated hollow units made of clear, colorless glass with a polyvinyl butyral edge coating.
 - a. Pattern type: Clear

2.3 ACCESSORIES

- A. Panel Reinforcing: two parallel 9-gauge wires either 1% inch or 2 inch on center with electrically butt-welded cross-wires spaced at regular intervals, galvanized after welding, by Pittsburgh Corning Corporation.
- B. Panel Anchors: 20 gauge perforated steel strips 24 inches long by 1¾ inches wide, hot-dipped galvanized after perforation, by Pittsburgh Corning Corporation.
- C. Expansion Strips: made of polyethylene foam with a thickness of 3/s inch, by Pittsburgh Corning Corporation.
- D. Asphalt Emulsion: a water-based asphalt emulsion, by Karnak Chemical Corp. (Karnak 100, 1,800-526-4236), or equal.
- E. Sealant (caulk): non-staining, waterproof mastic, silicone type.
- F. Packing (Backer Rods): polyethylene foam, neoprene, fibrous glass or equal as approved by sealant manufacturer

2.4 MORTAR MATERIALS

Mortar: Type Sin accordance with ASTM C270. Mortar shall be 1 part Portland Cement, ½ part lime, and sand equal to 2¼ to 3 times the amount of cementitious material (cement plus lime). all measures by volume. (For exterior glass block panels, an integral type waterproofer should be added to the mortar mix.) No antifreeze compounds or accelerators allowed.

- A. Portland Cement: Type 1 in accordance with ASTM C150. If a waterproof Portland Cement is used, the integral type waterproofer shall be omitted. (Masonry Cement is not recommended.)
 - a. Color: White
- B. Lime: Type S, in accordance with ASTM C207. Shall be a pressure-hydrated dolomitic lime, provided that not less than 920/o of all the active ingredients are completely hydrated.
- C. Sand: A clean, white quartzite or silica type, essentially free of iron compounds, for thin joints, in accordance with AST M C144, not less than 1000/o passing a No. 8 sieve.

- D. Integral Type Waterrepellent: Stearate type by Sonneborn Building Products (Hydrocide Powder, 1-800-243-6739), or equal. Note: Add hydrocide powder to dry mortar mix. Do not add powder to wet mortar mix.
- E. External Type Waterproof: Water based silane sealer type by Harris Specialty Chemicals, Inc. (ENVIROSEAL" 20 or HYDROZO CLEAR 20, 1-800-327-1570). Note: Remove excess sealer from glass surfaces soon after application.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Verify that (channels), (panel anchors) have been provided at head and jambs for the purpose of providing panel support within the opening.
- B. Mix all mortar components to a consistency that is drier than mortar for ordinary masonry. Retempering the mortar after it has taken its initial set shall not be permitted. Do not use antifreeze compounds or accelerators.
- C. Freshly mixed mortar may create skin irritation. Avoid direct contact where possible and wash exposed skin areas promptly with water. If any mortar gets into the eyes, rinse immediately with water and get prompt medical attention.

3.2 INSTALLATION

- A. Cover sill area with a heavy coat of asphalt emulsion. Allow emulsion to dry at least 2 hours before placing mortar.
- B. Where panel anchors are used at jambs and heads in lieu of channel or chase surrounds, install panel anchors in the same joints (16 inches o.c. maximum) where panel reinforcing will be laid. EXCEPT THAT, at panel corners, anchors shall be placed in each mortar joint, both at the jamb and head, 24 inches on each side of the corner. Install panel anchors across head joint spaced 16 inches o.c. maximum.
- C. Adhere expansion strips to jambs and head. Make certain expansion strip extends to sill and covers leg of panel anchor which is attached to jambs and head.
- D. Set a full mortar bed joint, applied to sill.
- E. Set lower course of block. Maintain a uniform joint width of $\frac{1}{4}$ to $\frac{3}{8}$ inch plus or minus $\frac{1}{8}$ inch. All mortar joints must be full and not furrowed. Steel tools must not be used to tap blocks into position. (Place a rubber crutch tip on end of trowel to tap block into position). Do not realign, tap or otherwise move block after initial placement. For VISTABRIK® solid glass block units, typical mortar joint is $\frac{3}{8}$ inch. Special VISTABRIK® spacers that provide a $\frac{3}{8}$ inch thick mortar joint are available.
- F. Install panel reinforcing every 16 inches o.c. maximum in the horizontal mortar joint and in joints immediately above and below all openings within panels. Run reinforcing continuously from end to end of panels. Lap reinforcing not less than 6 inches whenever it is necessary to use more than one length. NOTE: In corrosive atmospheres, (i.e. saline air, chlorine air, etc.), the use of stainless steel channels, reinforcing and panel anchors should be considered. For VISTABRIK® solid glass block, use $\frac{11}{16}$ inch wide reinforcing (same as Thinline® Series glass block). Do not bridge expansion joints with reinforcing. Install reinforcing as follows:

- Place lower half of mortar in bed joint. Do not furrow.

- Press panel reinforcing into place.
 - Cover panel reinforcing with upper half of mortar bed and trowel smooth. Do not furrow.
- G. Place full mortar bed for joints not requiring panel reinforcing· do not furrow. Maintain uniform joint width.
- H. Set succeeding courses of block. Space at head of panel and jambs must remain free of mortar for caulking with sealant.
- I. Use only wooden or rubber tipped tools when tapping glass blocks in place.
- J. Strike joints smooth while mortar is still plastic and before final set. Remove surplus mortar from faces of glass blocks and wipe dry. (See Section 3.03). Tool joints smooth and concave before mortar takes final set. (Remove wedges from lower courses of VISTABRIK® solid glass blocks and point the voids with mortar.) At this time, remove and clean out all excess mortar from jamb, head and other locations.
- K. After final mortar set (approximately 24 hours),install packing tightly between glass block panel and jamb and head construction. Leave space for sealing.
- L. Apply sealant evenly to the full depth of recesses as indicated on the drawings and in accordance with the manufacturer's application manual and instructions.
- M. A/1 exterior glass block panels shall be well sealed to prevent water entry.

3.3 CLEANING

- A. Remove surplus mortar from the faces of the glass block at the time joints are struck or tooled. Mortar should be removed while it is still plastic using a clean, wet sponge or an ordinary house-hold scrub brush having stiff bristles.
- B. Do not use harsh cleaners, acids (of any strength), abrasives or alkaline materials while cleaning glass block. Never use a wire brush to remove mortar from glass block surfaces.
- C. Final mortar removal is accomplished with a clean. wet sponge or cloth. Rinse sponge or cloth frequently in clean water to remove abrasive particles that could scratch glass surfaces. Allow any remaining film on the block to dry to a powder.
- D. After all organic sealants, caulking, etc., have been applied. remove excess caulking materials with commercial solvents such as xylene, toluene, mineral spirits or naptha and follow with normal wash and rinse. Be careful not to damage caulking by over generous application of strong solvents. Comply with solvent manufacturer's directions on label for toxicity and flammability warnings.
- E. Final cleaning of glass block panels is accomplished after they are completely installed. Wait until panels are not exposed to direct sunlight. Start at the top of the panel and wash with generous amounts of clean water. Dry all water from the glass block surface. Change cloth frequently to eliminate dried mortar particles or aggregate that could scratch the glass surface. To remove the dry powder from the glass surfaces, use a clean, dry, soft cloth. For stubborn or hard to remove powder or stains, the use of an "extra fine" steel wool (grades 000 or 0000) is suggested. Try this first in an unobtrusive area.

END OF SECTION

SECTION 04810

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes brick, concrete masonry units, reinforcement, anchorage, and accessories.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Submit data for brick masonry units and fabricated wire reinforcement wall ties, anchors, and other accessories.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.
- B. Fire Rated Wall Construction: Rating as indicated on Drawings.
 - 1. Tested Rating: Determined in accordance with ASTM E119.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.
- B. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 PRODUCTS

2.1 UNIT MASONRY ASSEMBLIES

- A. Manufacturers:
 - 1. Grand Blanc Cement Products.

2.2 COMPONENTS

- A. Hollow Load Bearing Concrete Masonry Units: ASTM C90; normal weight.
- B. Solid Load-Bearing Concrete Masonry Units: ASTM; normal weight.
- C. Hollow, Solid Non-Load Bearing Concrete Masonry Units: ASTM C1 normal weight.
- D. Concrete Brick Units: ASTM C55, same weight as block units.

- E. Concrete Masonry Unit Size and Shape: Nominal modular size of 8 x 16 x 8 inches. Furnish special units for 90-degree corners, bond beams and lintels.
- F. Split Face Concrete Masonry Units: Pre-colored to match existing two colors. ASTM C1 normal weight.
- G. Split Face Concrete Masonry Unit Size and Shape: Nominal modular size 4 x 6 x 8 inches. Furnish special units for 90-degree corners bond beams.
- H. Ground Face Concrete Masonry Units: Precolored to match existing units. ASTM C1, normal weight.
- I. Ground Face Concrete Masonry Units Size and Shape: Nominal modular size, 4 x 16 x 8 and 4 inches.

2.3 ACCESSORIES

- A. Single Wythe Joint Reinforcement: ASTM A951; ladder type; steel: 0.188-inch diameter side rods with 0.148-inch diameter cross ties; hot dip galvanized.
- B. Multiple Wythe Joint Reinforcement: ASTM A951; ladder type; steel with moisture drip; adjustable type; 0.188-inch diameter side rods with 0.148-inch diameter cross ties; hot dip galvanized.
- C. Reinforcing Steel: ASTM A615/A615M, ksi yield grade, deformed billet bars, galvanized.
- D. Strap Anchors: bent steel shape, 2 x 12-inch, 1/4-inch thick: ASTM A153/A153M hot dip galvanized.
- E. Wall Ties: ASTM A82; steel wire diameter, adjustable eye and pintle type; ASTM A153/A153M hot dip galvanized.
- F. Anchor Rods: ASTM A307; Grade C; J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15-inch embedment; galvanized finish.
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 55.
- G. Mortar and Grout: As specified in Section 04065.
- H. Self-stick SBS type flashing.
- I. Lap Sealant Butyl type as specified in Section 07900.
- J. Preformed Control Joints: Rubber Polyvinyl chloride material. Furnish with corner and tee accessories.
- K. Joint Filler: Closed cell polyvinyl chloride oversized 50 percent to joint width; self-expanding.
- L. Building Paper: ASTM D226; Type I, No. 15 unperforated asphalt felt.

- M. Weeps: Preformed plastic tubes, size 3/8-inch x 1 ½ inch x 3 ½ inches with stainless steel insect screen insert.
- N. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, recommended by masonry unit manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

- A. Coordinate placement of anchors supplied by other sections.
- B. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

- A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- B. Coursing of Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave. Raked at interior exposed single score units, concave at exposed exterior split units, flush at non-exposed locations.
- C. Cut mortar joints flush where ceramic or quarry wall tile is scheduled, resilient base is scheduled, cavity insulation vapor retarder adhesive is applied, or bituminous damp proofing is applied.
- D. Placing and Bonding:
 - 1. Isolate masonry partitions from vertical structural framing members with movement joint as indicated on Drawings.
 - 2. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.
- E. Weeps and Vents: Install weeps and vents in outer wythe at 32 inches oc horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- F. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes. Build inner wythe ahead of outer wythe to receive cavity insulation air/vapor retarder adhesive.

- G. Joint Reinforcement and Anchorage - Single Wythe Masonry:
1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first [and second] joint below top of walls.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
 3. Reinforce joint corners and intersections with strap anchors 16 inches oc.
- H. Joint Reinforcement and Anchorage - Masonry Veneer:
1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
 3. Embed wall ties in masonry backing to bond veneer at maximum 16 inches oc vertically and 16 inches oc horizontally. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb of wall openings.
 4. Secure wall ties to stud framed backing and embed into masonry veneer at maximum 6 inches oc vertically and 16 inches oc horizontally.
 5. Place wall ties at maximum 8 inches oc vertically within 8 inches of jamb or wall openings.
 6. Place wall ties at maximum 8 inches on center horizontally within 8 inches of head and sill of wall openings.
- I. Joint Reinforcement and Anchorages - Cavity Wall Masonry:
1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
 3. Embed anchors in concrete. Attach anchors to structural steel members. Embed anchorages in every second block or sixth brick joint.
 4. Reinforce joint corners and intersections with strap anchors 16 inches oc.
- J. Joint Reinforcement and Anchorages - Multiple Wythe Unit Masonry:
1. Install horizontal joint reinforcement 16 inches oc. Place joint reinforcement continuous in first and second joint below top of walls.
 2. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
 3. Support and secure reinforcing bars from displacement. Maintain position within $\frac{1}{2}$ inch of dimensioned position.
 4. Embed anchors in concrete. Attach anchors to structural steel members. Embed anchorages in every second block or sixth brick joint.
 5. Reinforce joint corners and intersections with strap anchors 16 inches oc.
- K. Masonry Flashings:
1. Extend flashings horizontally through outer wythe at foundation walls, above ledge or shelf angles and lintels, under parapet caps, at bottom of walls, and turn down on outside face to form drip.
 2. Turn flashing up minimum 8 inches and bed into mortar joint of masonry or seal to concrete or seal to sheathing over steel stud framed back-up.
 3. Lap end joints and seal watertight.
 4. Turn flashing, fold, and seal at corners, bends, and interruptions.

- L. Lintels:
1. Install loose steel, lintels over openings.
 2. Maintain minimum 6-inch bearing on each side of opening.
- M. Grouted Components:
1. Reinforce bond beam and pilasters as detailed.
 2. Support and secure reinforcing bars from displacement.
 3. Place and consolidate grout fill without displacing reinforcing.
 4. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.
- N. Control and Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
 - a. Exterior Walls: 20 feet on center and within 24 inches on one side of each interior and exterior corner.
 - b. Interior Walls: 30 feet on center.
 - c. At changes in wall height.
 2. Do not continue horizontal joint reinforcement through control and expansion joints.
 3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
 4. Install preformed control joint device in continuous lengths. Seal butt and corner joints.
 5. Size control joint in accordance with Section 07900 for sealant performance.
 6. Form expansion joint as detailed.
- O. Built-In Work:
1. As work progresses, install built-in metal door and glazed frames, fabricated metal frames, window frames, anchor bolts, plates, and other items to be built in the work furnished by other sections.
 2. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- P. Cutting and Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- Q. Cleaning:
1. Remove excess mortar and mortar smears as work progresses.
 2. Clean soiled surfaces with cleaning solution.
- R. Tolerances:
1. Maximum Variation from Plumb: 1/4-inch per story non-cumulative; 1/2-inch in two stories or more.
 2. Maximum Variation from Level Coursing: 1/8-inch in 3 ft. and 1/4-inch in 10 ft 1/2" in 30 ft.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural shapes.
 - 2. Channels and angles.
 - 3. Hollow structural sections.
 - 4. Structural pipe.
 - 5. Structural plates and bars.
 - 6. Fasteners, connectors, and anchors.
 - 7. Grout.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, cambers, loads and welded connections.
- B. Connections: Provide details of steel connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. AISC Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC Seismic Provisions for Structural Steel Buildings.
 - 3. RCSC Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

1.4 QUALIFICATIONS

- A. Fabricator: Company specializing in performing Work of this section with minimum three years' experience with the following current AISC Certification:
 - 1. Standard Steel Building Structures (STD).
 - 2. Conventional Steel Building Structures (SBD).
- B. Erector: Company specializing in performing Work of this section with minimum three years' experience with the following current AISC Certification:
 - 1. Certified Steel Erector (CSE).
- C. Shop Painter: Company specializing in performing Work of this section with minimum three years' experience.
- D. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural W-Shapes: ASTM A992/A992M. Grade 50.
- B. Channels and Angles: ASTM A36/A36M.
- C. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.
- D. Structural Pipe: ASTM A53/A53M, Grade B.
- E. Structural Plates: ASTM A36/A36M

2.2 FASTENERS, CONNECTORS, AND ANCHORS

- A. High Strength Bolts: ASTM A325; Type 1.
 - 1. Finish: Unfinished.
- B. Nuts: ASTM A563 heavy hex type.
 - 1. Finish: Unfinished.
- C. Washers: ASTM F436; Type 1, circular.
 - 1. Finish: Unfinished.
- D. Tension Control Assemblies: ASTM F1852; Type 1, heavy hex or round head, twist off type; complete with washers and heavy hex nuts.
 - 1. Finish: Finish: Unfinished.
- E. Shear Connectors: ASTM A108; Grade 1015-1020, headed, unfinished and in accordance with AWS D1.1; Type B.
- F. Anchor Rods: ASTM F1554; Grade 36.
 - 1. Shape: Hooked or Straight.
- G. Threaded Rods: ASTM A36/A36M.
 - 1. Finish: Unfinished.

2.3 WELDING MATERIALS

- A. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 ACCESSORIES

- A. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi at 28 days.
- B. Shop Primer: SSPC Paint 15, Type 1.
- C. Touch-Up Primer: Match shop primer.
 - 1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic.

1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.

2.5 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- B. Fabricate connections for bolt, nut, and washer connectors.
- C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
 1. Cut, drill holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge by burning.
 2. Base plate holes: Cut, drill, punch holes perpendicular to steel surfaces.

2.6 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 3.
- B. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete or high strength bolted.
- C. Galvanizing for Structural Steel Members: ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.
- D. Galvanizing for Fasteners, Connectors, and Anchors:
 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.7 SOURCE QUALITY CONTROL AND TESTS

- A. Shop test bolted and welded connections as specified for field quality control tests.
- B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify bearing surfaces are at correct elevation.
- B. Verify anchor rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

- A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

- A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on Drawings and/or shop drawings.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

- A. Shim bearing plates and equipment supports to proper elevation, snug tighten anchor bolts.
- B. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.
- C. Moist cure grout.
- D. Remove forms after grout is set. Trim grout edges to form smooth surface, splayed 45 degrees.
- E. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 FIELD QUALITY CONTROL

- A. Bolted Connections: Inspect in accordance with AISC specifications.
 - 1. Visually inspect all bolted connections.
 - 2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.
- B. Welding:
 - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. Visually inspect all welds.
 - 3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
- C. Correct defective bolted connections and welds.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated ferrous metal items, galvanized and prime painted.

1.2 SYSTEM DESCRIPTION

- A. Design handrail, and attachments to resist forces as required by 2012 Michigan Building Code. Apply loads non-simultaneously to produce maximum stresses.
 - 1. Handrail Concentrated Load: 200 pounds applied at any point in any direction.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.4 QUALITY ASSURANCE

- A. Finish joints in accordance with NOMMA Guideline 1.
- B. Design under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Michigan.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Plate: ASTM A36/A36M.
- C. Tubing: ASTM A513, Type 5, minimum 50 ksi yield strength.
- D. Hollow Structural Sections: ASTM A500, Grade B.
- E. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40.

- F. Bolts: ASTM A307; Grade A or B.
 - 1. Finish: Unfinished.
- G. Nuts: ASTM A563 heavy hex type.
 - 1. Finish: Unfinished.
- H. Washers: ASTM F436; Type 1.
 - 1. Finish: Unfinished.
- I. Handrail Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast steel.
- J. Anchor Rods: ASTM F1554; Grade 55, weldable.
 - 1. Shape: Hooked.

2.2 ACCESSORIES

- A. Welding Materials: AWS D1.1.
- B. Shop Primer: SSPC Paint 15, Type 1, red oxide.
- C. Touch-Up Primer: Match shop primer.
 - 1. Interior Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic.
 - 1. Anti-Corrosive Paints: Maximum volatile organic compound content in accordance with GC-03.
- E. Concrete and Reinforcement for Treads and Landings: Mesh Bar type, Portland cement, as specified in Section 03050.

2.3 FABRICATION

- A. General:
 - 1. Fit and shop assemble items in largest practical sections, for delivery to site.
 - 2. Continuously seal joined members by continuous welds.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
 - 4. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, consistent with design of component.
 - 5. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication.
 - 6. Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.
 - 7. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish.

- B. Handrails:
 - 1. Fit and shop assemble components in largest practical sizes, for delivery to site.
 - 2. Grind exposed joints flush and smooth with adjacent finish surface.
 - 3. Accurately form components to suit stairs and landings, to each other and to building structure.

2.4 FINISHES

- A. Prepare surfaces in accordance with SSPC SP.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Shop prime items with one coat. Do not prime surfaces in direct contact with concrete or where field welding is required.
- D. Galvanizing for Components: ASTM A123/A123M; minimum 1.2 oz/sq. ft coating thickness; galvanize after fabrication.
- E. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

- A. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads and provide temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.
- D. Obtain approval prior to site cutting.
- E. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 SCHEDULES

- A. This Schedule is list of principal items only. Refer to Drawing details for items not specifically scheduled.
- B. Ledge and Shelf Angles, Plates Not Attached to Structural Framing: For support of metal decking joists, masonry grating; prime paint galvanized natural finish.
- C. Lintels: As detailed; galvanized finish.

3.5 FIELD QUALITY CONTROL

- A. Welding: Inspect welds in accordance with AWS D1.1.

END OF SECTION

SECTION 06100
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall, and roof framing; built-up structural members; shop fabricated trusses; wall and roof sheathing; subfloor sheathing; sill gaskets and roof curbs; blocking in wall and roof openings; wood furring and grounds; electrical panel back boards, concealed wood blocking.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate framing system, loads and cambers, bearing details and framed openings.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association and APA - American Plywood Association.
 - 3. Lumber: DOC PS 20.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Fire Rated Wall Construction: Rating as indicated on Drawings one hour rating.
 - 1. Tested Rating: Determined in accordance with ASTM E119.
- C. Surface Burning Characteristics:
 - 1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255, UL 723.
- D. Apply label from agency approved by authority having jurisdiction to identify each fire retardant treated material.

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: RIS.
- B. Non-structural Light Framing: Hem/Fir species, No. 2 grade, 2 x 4 size classification, 19 percent maximum moisture content.
- C. Studding: Southern Pine species, No. 2 grade or better, 2 x 6 size classification, 19 percent maximum moisture content.
- D. Sill Plate: Pressure treated.

2.2 SHEATHING MATERIALS

- A. Plywood Roof Sheathing: Structural I, 5/8 inch thick 48 x 96 inch plywood or oriented strand board Span Rating 32/16; Exposure Durability 1; sanded.

- B. Plywood Flat Roof Sheathing: Structural 1, $\frac{3}{4}$ inch thick 48 x 96 inch plywood or oriented strand board, span rating 32/16; Exposure Durability 1; sanded.
- C. Wall Sheathing: Rated Sheathing Structural I plywood or oriented strand board, Span Rating 32/16; Exposure Durability 1; sanded.
- D. Telephone and Electrical Panel Boards: Plywood.

2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- A. Sloped Roof Sheathing: $\frac{5}{8}$ inch thick, 48 x 96 inch sized sheets, square edges.
- B. Flat Roof Sheathing: $\frac{3}{4}$ inch thick, 48 x 96 inch sized sheets, tongue and groove edges.
- C. Above Grade Wall Sheathing: $\frac{5}{8}$ inch thick, 48 x 96 inch sized sheets, square edges.

2.4 SHOP FABRICATED TRUSSES

- A. Truss Type: Plate connected, see Section 06173 for additional information.

2.5 FIREBLOCKING

- A. Fireblocking: Solid lumber, structural wood panel, or particleboard.
 - 1. Solid lumber nominal 2 inches thick.

2.6 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fasteners: Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Nails and Staples: ASTM F1667.
- B. Structural Framing Connectors: Galvanized steel, sized to suit framing conditions.
- C. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
- D. Sill Gasket on Top of Foundation Wall: Plate width, closed cell foam strip.
- E. Sill Flashing (Under Sill Gasket): Polyethylene sheet.
- F. Building Paper: Spun bonded polyethylene.

2.7 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): AWPA Treatment C1 using water borne preservative with 0.25 pcf retention.
- B. Wood Preservative (Surface Application): Clear type.
- C. Moisture Content after Treatment: Redried.
 - 1. Lumber: Maximum 19 percent.
 - 2. Structural Panels: Maximum 15 percent.

PART 3 EXECUTION

3.1 FRAMING

- A. Set structural members level and plumb, in correct position.
- B. Fasten framing in accordance with applicable code.
- C. Place horizontal members crown side up.
- D. Place full width continuous sill flashing on foundations.
- E. Place sill gasket directly on sill flashing.
- F. Frame double joist headers at floor and ceiling openings. Frame rigidly into joists. Frame double joists under wall studding.
- G. Bridge framing in excess of 8 feet span at mid-span members. Fit solid blocking at ends of members.
- H. Curb roof openings except where curbs are provided. Construct curb members of single pieces for each side.

3.2 SHEATHING

- A. Fasten sheathing in accordance with applicable code.
- B. Install sheathing to two span continuous.
- C. Secure wall sheathing with ends staggered, over firm bearing.
- D. Place building paper over wall sheathing, weather lap joints and end laps, staple in place. Coordinate flashing installation to ensure continuous water resistant barrier.
- E. Install solid edge blocking between sheets.
- F. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back board by 12 inches beyond size of electrical panel.

3.3 FIREBLOCKING

- A. Install fireblocking to cut off concealed draft openings.
 - 1. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally at maximum 10 feet on center.
 - 2. Connections Between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
 - a. Roof framing.
 - b. Soffits, dropped ceilings, cove ceilings and other horizontal concealed spaces.

3.4 SITE APPLIED WOOD TREATMENT

- A. Treat site-sawn cuts. Brush apply one coats of preservative treatment on untreated wood in contact with cementitious materials, roofing and related metal flashings.
- B. Allow preservative to cure prior to erecting members.

END OF SECTION

SECTION 06173

WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated wood trusses for roof framing; bridging, bracing, and anchorage; and preservative treatment of wood.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate sizes and spacing of trusses and associated components, web and chord sizes, plate sizes, fastener descriptions and spacings, loads and truss cambers, framed openings. Submit design calculations.
- B. Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by APA - the American Plywood Association.
 - 3. Lumber: DOC PS 20.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Truss Design, Fabrication, and Installation: In accordance with TPI 1.
- C. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- D. Design trusses under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Lumber Grading Rules: RIS.
- B. Wood Members: Single top and bottom chord, Stress Group B, Hem/Fir species, 19 percent maximum and 7 percent minimum moisture content.
- C. Steel Plate Connectors: TPI 1, Section 6; hot dip galvanized; die stamped with integral teeth.
- D. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.2 ACCESSORIES

- A. Wood Blocking Support Members Framing for Openings: In accordance with Section 06100 softwood lumber, S/P/F species, construction grade, 19 percent maximum and 7 percent minimum moisture content.
- B. Fasteners and Anchors:
 - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Nails and Staples: ASTM F1667.
- C. Bearing Plates: Electro-galvanized

2.3 FABRICATION

- A. Fabricate trusses to achieve structural requirements specified.
- B. Furnish bottom and top chord extensions as indicated on Drawings.
- C. Frame special sized openings in web framing as detailed.

2.4 SOURCE QUALITY CONTROL

- A. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.
- B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop inspections are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify supports and openings are ready to receive trusses.

3.2 PREPARATION

- A. Coordinate placement of bearing and support items.

3.3 ERECTION

- A. Set members level and plumb, in correct position.
- B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in indicated alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. Place headers and supports to frame openings.
- E. Frame openings between trusses with lumber in accordance with Section 06100.
- F. Coordinate placement of sheathing with work of this section.

G. After erection, touch-up damaged surfaces with primer consistent with shop coat.

3.4 ERECTION TOLERANCES

A. Framing Members: ½ inch maximum, from indicated position.

END OF SECTION

SECTION 06200
FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes finish carpentry items, other than shop prefabricated casework; hardware and attachment accessories.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories.
- B. Samples: Submit two, 2 x 3-inch size samples illustrating wood grain and specified finish.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI Quality Standards, Custom Grade. WI Manual of Millwork, Custom Grade.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Softwood Lumber: PS 20; Graded in accordance with AWI Custom; Pine species, maximum moisture content of 6 percent; with grain, of quality suitable for transparent finish.
- B. Softwood Plywood: PS 1 Grade AB; Graded in accordance with AWI Custom core; Douglass Fir face species.
- C. Wood Particleboard: ANSI A208.1 Type 1 standard, composed of wood chips, sawdust, or flakes of medium density, made with high waterproof resin binders; of grade to suit application; sanded faces.
- D. Plastic Laminate: NEMA LD 3 AWI; 0.050-inch General Purpose Premium quality; color, pattern, and gloss, matte, textured surface texture as indicated on drawings.
- E. Laminate Backing Sheet: 0.020-inch Backing Sheet grade, undecorated plastic laminate.

2.2 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Nails and Staples: ASTM F1667.
- B. Contact Adhesives: Water Base type.
 - 1. Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

- 2. Aerosol Adhesives: Maximum volatile organic compound content in accordance with GS-36.
- C. Wall Adhesive: Cartridge type, compatible with wall substrate, capable of achieving durable bond.
 - 1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- D. Primer: Alkyd primer sealer type.
 - 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.
- 2.3 FABRICATION
 - A. Fabricate to AWI Custom standards.
- 2.4 SOURCE QUALITY CONTROL
 - A. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.

PART 3 EXECUTION

- 3.1 EXAMINATION
 - A. Verify field conditions are acceptable and are ready to receive work.
- 3.2 PREPARATION
 - A. Prime paint surfaces of items or assemblies in contact with cementitious materials, before installation.
- 3.3 INSTALLATION
 - A. Install work in accordance with AWI Custom quality standard.
 - B. Set and secure materials and components in place, plumb and level.
 - C. Install trim by nails.
 - D. Apply plastic laminate finishes with adhesive over entire surface. Apply laminate backing sheet on reverse side of plastic laminate finished surfaces.
 - E. Install hardware supplied by Section 08710.

END OF SECTION

SECTION 07132

SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. Installation of sheet membrane waterproofing on surfaces indicated on drawings, consisting of preparation of existing and repaired concrete surfaces, sealing of cracks and joints, and application of CCW MiraDRI 860/861 Sheet Membrane Waterproofing.

1.2 REFERENCES

- A. ASTM D412 Tests for Rubber Properties in Tension.
- B. ASTM E154 Puncture Resistance.
- C. ASTM E96 (B) Water Vapor Transmission of Materials.
- D. ASTM D1970 Self-Adhering Polymer Modified Bituminous Sheet Materials.
- E. ASTM D882 Test Method for Tensile Properties.
- F. ASTM D3767 Practice for Rubber – Measurement of Dimensions.
- G. ASTM D751 Test Method for Coated Fabrics.
- H. ASTM D570 Test Method for Water Absorption of Plastics.
- I. UL 790 Tests for Fire Resistance of Roof Covering Materials.

1.3 SYSTEM DESCRIPTION

- A. Product provided by this Section is a self-adhesive membrane of not less than 60 mils thickness, consisting of a rubberized asphalt membrane laminated to a 4-mil cross-laminated polyethylene film.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature and installation instructions.
- B. Subcontractor's approval by Manufacturer: Submit document stating manufacturer's acceptance of subcontractor as an Approved Applicator for the specified materials.
- C. Warranty: Submit a sample warranty identifying the terms and conditions.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Applicator shall be experienced in applying the same or similar materials and shall be specifically approved in writing by the membrane manufacturer.

- B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).
- C. Pre-Application Conference: Prior to beginning work, convene a conference to review conditions, installation procedures, schedules, and coordination with other work.

1.6 WARRANTY

- A. Upon completion and acceptance of the work required by this section, the manufacturer will issue a warranty agreeing to promptly replace defective materials for a period of 5 years.
- B. The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity, and heating/ventilating systems and their maintenance and operating capabilities. These factors are beyond the control of Carlisle and Carlisle shall not be responsible for any claims, repairs, restoration, or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like in any building or in the air, land, or water serving the building.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to project site in original, factory-sealed, unopened containers bearing manufacturer's name and label intact and legible with following information.
 - 1. Name of material.
 - 2. Manufacturer's stock number and date of manufacture.
 - 3. Material safety data sheet.
- B. Store materials in protected and well-ventilated area.

1.8 PROJECT CONDITIONS

- A. Do not apply membrane when surface temperature is below or inclement weather conditions conflict with manufacturer's published requirements.
- B. Coordinate waterproofing work with other trades. The applicator shall have sole right of access to the specified areas for the time needed to complete the installation.
- C. Warn personnel against breathing of vapors and contact of material with skin or eyes. Wear applicable protective clothing and respiratory protection gear.
- D. Keep flammable products away from spark or flame. Do not allow the use of spark producing equipment during application and until all vapors have dissipated. Post "NO SMOKING" signs.
- E. Maintain work area in a neat and orderly condition, removing empty containers, rags, and rubbish daily from the site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide CCW MiraDRI 860/861 Sheet Membrane Waterproofing as manufactured by Carlisle Coatings and Waterproofing Incorporated, 900 Hensley Lane, Wylie, Texas 75098, Phone: (800) 527-7092 Fax: (972) 442-0076.
- B. Substitutions: Permitted of equal quality material.

2.2 PRODUCTS

- A. Self-Adhesive Sheet Membrane Waterproofing: Shall be CCW MiraDRI 860/861 consisting of a 56 mil rubberized asphalt membrane laminated to 4 mil cross-laminated polyethylene film, and shall meet or exceed the following requirements:
 - 1. Tensile Strength: 325 psi minimum, ASTM D412.
 - 2. Ultimate Elongation: 350% minimum, ASTM D412.
 - 3. Puncture Resistance: 60 lbs. minimum, ASTM E154.
 - 4. Permeance: 0.05 Perm maximum, ASTM E96 (B).
 - 5. Low Temperature Flexibility: Unaffected at -45°F, ASTM D1970, 1" mandrel.
 - 6. Tensile to Film: 5000 psi, ASTM D882
 - 7. Thickness: 60 mils, ASTM D3767.
 - 8. Hydrostatic Head: 230 ft., ASTM D751.
 - 9. Water Absorption: 0.1% by wt., ASTM D570.
- B. For application temperatures between 25 and 65°F, use CCW-861 Sheet Membrane and CCW-702. For application temperatures above 40°F use CCW MiraDRI 860 sheet membrane and CCW-702, CCW-714 primer, or CCW-AWP.

2.3 ACCESSORY PRODUCTS

- A. Surface Primer: Shall be CCW-702LV Solvent-Based Contact Adhesive, 702WB or Cav-Grip.
- B. Mastic: Shall be CCW-704 Mastic.
- C. Sealants: Shall be CCW-703 Vertical Grade Liquiseal⁷ Membrane, one component approved sealant by CCW, CCW-201 two-component Polyurethane Sealant or CCW LM-800XL.
- D. Backing Rod: Shall be closed-cell polyethylene foam rod.
- E. Protection Course: Shall be CCW Protection Board-H or CCW 300H for horizontal surfaces or CCW Protection Board-V or CCW 200V for vertical surfaces.
- F. Drainage Composite: Shall be CCW MiraDRAIN[®] as recommended by the manufacturer for each condition.

PART 3 EXECUTION

3.1 INSPECTION

- A. Before any waterproofing work is started the waterproofing applicator shall thoroughly examine all surfaces for any deficiencies. Should any deficiencies exist, the architect, owner, or general contractor shall be notified in writing and corrections made.
- B. Condition of Concrete Surfaces:
 - 1. The concrete surfaces shall be of sound structural grade and shall have a smooth finish, free of fins, ridges, protrusions, rough spalled areas, loose aggregate, exposed coarse aggregate, voids or entrained air holes. Rough surfaces shall receive a well-adhered parget coat.
 - 2. Concrete shall be cured by water curing method. Any curing compounds must be of the pure sodium silicate type and be approved by the Carlisle representative.
 - 3. Concrete shall be cured at least 7 days and shall be sloped for proper drainage.
 - 4. Voids, rock pockets and excessively rough surfaces shall be repaired with approved non-shrink grout or ground to match the unrepaired areas.
 - 5. Two-stage drains shall have a minimum 3-inch flange and be installed with the flange flush and level with the concrete surface.
 - 6. Surfaces at cold joints shall be on the same plane.

3.2 SURFACE PREPARATION

- A. The concrete surface must be thoroughly clean, dry, and free from any surface contaminants or cleaning residue that may harmfully affect the adhesion of the membrane.
- B. Install a 3/4" face, 45-degree cant of CCW-201 Polyurethane Sealant or CCW LM-800XL at all angle changes and inside corners including penetrations through the deck, walls, curbs, etc.
- C. All cracks over 1/16" in width and all moving cracks under 1/16" in width shall be routed out to 1/4" minimum in width and depth and filled flush with an approved sealant by CCW or CCW-201 polyurethane sealant.
- D. All expansion joints less than 1" wide shall be cleaned, primed, fitted with a backing rod and caulked with CCW-201 Polyurethane Sealant. For larger joints, contact Carlisle representative.
- E. Allow all sealant to cure at least overnight.
- F. Stir Primer. Apply a thin film of primer 10" wide, centered over sealed cracks and joints, hairline cracks, and cold joints. Apply primer 8" on each side of all corners. Prime concrete around drain flanges. Allow primer to dry per manufacturer's recommendations.
- G. Install an 8" wide strip of CCW MiraDRI 860/861 centered over joints and cracks. Install a 12" wide strip of CCW MiraDRI 860/861 centered over the axis of all corners.
- H. Terminate membrane around drains per CCW MiraDRI 860 series details. Terminate the membrane under the clamping ring. Seal all edges with CCW-704 Mastic. Do not interfere with weep holes

3.3 APPLICATION

- A. Priming: Clean surfaces to remove residual dust before priming. Stir primer. Apply by spray or roller at a rate recommended by manufacturer. Allow to dry per manufacturer's recommendation.
- B. Vertical Surfaces: Apply in lengths of 8' or less. Overlap edge seams 2½". On walls over 8' high, apply in 8' sections, starting at the lowest point with the higher section overlapping the lower section 5". Roll in place using firm pressure with a hand roller.
- C. Terminations: Consult Carlisle 860-9 Details for proper terminations. Roll terminating edges firmly. Apply CCW-704 mastic to all terminations and >T - joints. Apply CCW-704 Mastic or CCW-703-V Liquiseal to laps at angle changes, extending 9" in each direction.

3.4 INTEGRITY TESTING

- A. Test is required for all expanded warranties beyond the standard material warranty of horizontal applications.
- B. The test can be done with Electronic Vector Mapping or flood testing. Flood testing requires 2" minimum head of water for a period of 24 hours.

3.5 PROTECTION COURSE

- A. VERTICAL APPLICATION: Install CCW QuickDRAIN Perimeter Drainage System as the first course of drainage composite immediately after membrane has been installed on vertical surfaces. Install CCW MiraDRAIN Drainage Composite (consult CCW for recommendation), CCW Protection Board-V Protection Course or CCW 200V on remainder. Stop drainage composite 6" below final grade level.

END OF SECTION

SECTION 07210
BUILDING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes board thermal insulation and adhesive vapor retarder at exterior wall construction.
- B. Refer to Divisions 0 and Division 1 requirements. Requirements of these divisions of these and the project drawings shall govern work of this section.

1.2 SYSTEM DESCRIPTION

- A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including thermal performance of materials.

1.4 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255.
- B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

PART 2 PRODUCTS

2.1 BUILDING INSULATION

- A. Manufacturers:
 - 1. Dow Chemical - Extruded-Polystyrene Insulation.
 - 2. Johns Manville - Polyisocyanurate Insulation.
 - 3. Substitutions: Permitted.

2.2 COMPONENTS

- A. Extruded Polystyrene Insulation: ASTM C578 Type VI, cellular type, with the following characteristics:
 - 1. Board Thickness: two- and three-inch thick.
 - 2. Thermal Resistance: R of 5.0 per inch.
 - 3. Water Absorption: In accordance with ASTM D2842 0.3 percent by volume maximum.
 - 4. Compressive Strength: Minimum 25 psi.
 - 5. Board Edges: Square edges.

2.3 ACCESSORIES

- A. Adhesive: Type recommended by insulation manufacturer for application.
 - 1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Tape: Polyethylene self-adhering type, mesh reinforced, 2-inch wide.
- C. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer, to be mechanically fastened to surface to receive board insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.
- B. Exterior Walls - Board Insulation:
 - 1. Adhere strip of polyethylene sheet over substrate joints with beads of adhesive. Tape seal joints.
 - 2. Apply same adhesive in to full bed 1/8 inch thick.
 - 3. Install boards on wall surface. Place skin surface of insulation against adhesive.
 - 4. Stagger joints. Butt edges and ends tight to adjacent board and to protrusions.
 - 5. Place strip of polyethylene sheet at perimeter of wall openings, from adhesive vapor retarder bed to window and door frame. Tape seal in place to ensure continuity of vapor retarder.
 - 6. Tape insulation board joints.

END OF SECTION

SECTION 07214

FOAMED IN PLACE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Polyisocyanurate spray insulation at wall and junctures of roof and dissimilar materials.

1.2 SUBMITTALS

- A. Product Data: Provide data on materials, describing insulation properties, surface burning characteristics.
- B. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special treatment.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 QUALIFICATIONS

- A. Manufacturer Company specializing in manufacturing the products specified in this section with minimum three (3) years' experience.
- B. Applicator: Company specializing in performing the work of this section with minimum three (3) years' experience and certified by the manufacturer.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame and smoke ratings, non-combustibility.
- B. Surface-Burning- Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Fire Resistance Characteristics: As determined by testing identical products (based on a 4 inch minimum thickness) according to ASTM E 199 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- D. Fire Resistance: Characteristics: As determined by testing identical products according to NFPA 285 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Toxicity/Hazardous Materials:
 - 1. Outgassing/Reactivity:
 - a. Formaldehyde: Products containing urea-formaldehyde will not be permitted.
 - b. Chlorofluorocarbons (CFCs)/HCFCs: Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- B. Store materials in an area protected from freezing and overheating damage and in accordance with manufacturer's instructions.
- C. Protect spray polyhedrane foam components as follows:
 - 1. Component A and B: Store between 60 degrees F and 90 degrees F.
 - 2. Component B can be frozen but must be protected from overheating over 120 degree F and prolonged storage over 100 degree F.
 - 3. Component B: Mix thoroughly prior to use.
 - 4. Components should be a matched set (system) as supplied by the manufacturer.
 - 5. Use components within their labeled shelf-life.
 - 6. Use components as supplied with no site alterations or additions.

1.7 PERFROMANCE CHARACTERISTICS

- A. Air Material Air Leakage Rate: Maximum material air leakage rate of less than 0.0004 cfm/ft² under a pressure differential of 0.3 in w.g. (1.6 psf) (0.02 L/m² at 75 Pa) per ASTM E 2178 or E 282.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Icynene, Inc., 5805 Whittle Road, Suite 110, Mississauga, Ontario L4Z2J1, Canada.
Telephone: 888-946-7325 Fax: 905-890-7784 Web Site: www.icynene.com
- B. Substitutions: Permitted.

2.2 MATERIALS

- A. Polyicynene Spray Insulation: Icynene; Proseal Eco (MD-R-210) is 100 percent water-blown closed cell spray foam product with an R-value of 4.9 per inch. Proseal Eco is a Class II vapor Diffusion retarder at 2.4 inches. SATM C 1029, Type II, minimum density of 2.2 lb/cu.ft. and minimum aged R-value at 1-inch thickness of 4.9 deg F x hx sq. ft./Btu at 75 deg F.
- B. Prime: Material: recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that substrate is free of any foreign material that will impede application.
- C. Verify that other work on and within space to be insulated is complete prior to application.
- D. Notify Architect of conditions that would adversely affect the application.

E. Beginning of installation means applicator accepts existing conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation.
- B. Mask and protect adjacent surfaces from overspray or damage.
- C. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence and other substrates that will affect application.

3.3 APPLICATION

- A. Apply insulation in accordance with manufacturer's written application instructions.
- B. Apply insulation to a reasonably uniform monolithic density without voids.
- C. Apply to minimum cured thickness as scheduled.
- D. Apply insulation to fill voids around doors and windows.
- E. Apply insulation to fill voids around accessible service and equipment penetrations.
- F. Apply insulation to seal voids at truss ends.
- G. Seal plumbing stacks, electrical wiring and other penetrations to control air leakage.

3.4 FIELD QUALITY CONTROL

- A. Inspect application for insulation thickness and density.

3.5 PROTECTION OF FINISHED WORK

- A. Do not permit subsequent work to disturb applied insulation.

END OF SECTION

SECTION 07218
SPRAYED INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cellulose insulation placed in roof.

1.2 REFERENCES

- A. ASTM International:
1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 2. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 3. ASTM C739 - Standard Specification for Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation.
 4. ASTM C1014 - Standard Specification for Spray-Applied Mineral Fiber Thermal or Acoustical Insulation.
 5. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 7. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
- B. Green Seal:
1. GS-11 - Product Specific Environmental Requirements.
- C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.
- D. National Fire Protection Association:
1. NFPA 255 - Test of Surface Burning Characteristics of Building Materials.
- E. Underwriters Laboratories, Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 2. UL - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Product Data: Submit data on materials, describing insulation properties and insulation stops.
- B. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255.

- B. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255.
 - 1. Attic Floor Insulation: Minimum 0.12 watt per sq cm critical radiant flux when tested in accordance with ASTM E970.
- C. Furnish and label cellulose loose fill insulation in accordance with CPSC 16, Parts 1209 and 1404.
- D. Meet all test requirements of ASTM C739 and ASTM E119.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation when ambient and surface temperatures are lower than 50 degrees F.
- B. Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of insulation materials.

1.7 SCHEDULING

- A. Apply insulation after hangers and supporting clips are installed but before subsequent construction is erected.

PART 2 PRODUCTS

2.1 SPRAYED INSULATION

- A. Manufacturers:
 - 1. Nu-Wool.
 - 2. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Cellulose Fiber Insulation: Treated cellulose fiber, color; conforming to the following test requirements:
 - 1. Conductivity: ASTM C177; 0.22 K.
 - 2. Density - ASTM D1622: 3.5 lb/cu ft, settled.
 - 3. NRC: 0.75 for 1 inch thickness.
 - 4. Moisture Absorption: Maximum 15 percent by weight.
 - 5. Flame Spread and Smoke Developed Rating - ASTM E84: Flame Spread: 15 and Smoke Developed: 5.
 - 6. Combustibility - ASTM E136: Non-combustible.

2.3 ACCESSORIES

- A. Insulation Baffles: Plasticized cardboard, profiled and sized to suit joist spacing and wall/sloped roof configuration.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces are clean, dry, and free of matter capable of inhibiting adhesion.
- B. Verify other Work on and within spaces to be insulated is complete prior to application.

3.2 PREPARATION

- A. Mask and protect adjacent surfaces from overspray or damage.
- B. Install insulation baffles between joists at wall/sloped roof construction to prevent insulation from covering soffit vents or from limiting air circulation from soffit to attic space.

3.3 INSTALLATION

- A. Apply insulation pneumatically to a uniform monolithic density without voids, minimum 3.5 pounds per cubic foot.
- B. Apply to minimum cured thickness as scheduled.
- C. Tamp wet insulation surface to improve adhesion and to achieve smooth surface.

3.4 FIELD QUALITY CONTROL

- A. Inspection includes verification of insulation thickness and density.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not permit subsequent construction work to disturb applied insulation.

3.6 SCHEDULE

- A. Exterior Wall Stud Cavity: 5 ½ inch thick.
- B. Interior Wall Stud Cavity: 3 ½ inch thick.
- C. Attic Space: 12 inch thick.

END OF SECTION

SECTION 07276

FLUID-APPLIED MEMBRANE AIR/WATERPROOFING BARRIERS

PART 1 GENERAL

1.1 SUMMARY

- A. Materials and installation of waterproofing/air barrier over vertical above grade wall sheathing.

1.2 DEFINITIONS

- A. Air Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air Barrier Accessory: A transitional component of the air barrier that provides continuity.
- B. Air Barrier Auxiliary Material: A transitional component that provides air barrier continuity furnished by a source other than the primary air barrier manufacturer.
- C. Air Barrier Assembly: The collection of Air Barrier Materials, accessory and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 MEETINGS

- A. Pre-Installation Conference:
 - 1. Review Air Barrier installation requirements and installation details, protection and sequence work.

1.4 SUBMITTALS

- A. Manufacturer's specifications, details and product data.
- B. Samples for approval as directed by Architect or Owner.
- C. Manufacturer's standard warranty.
- D. Manufacturer's ICC evaluation report confirming compliance with MBC 2015, IBC, as an air barrier.
- E. Shop Drawings: Substrate joints, cracks, flashing transitions, penetrations, corners, terminations and tie – ins with adjoining construction and waterfaces with separate materials that form a part of the air barrier assembly.

1.5 QUALITY ASSURANCE

- A. Manufacturer requirements
 - 1. Manufacturer of exterior wall waterproofing/air barrier materials for a minimum of 10 years in North America.
- B. Contractor requirements

1. Knowledgeable in the proper use and handling of manufacturer's materials.
 2. Employ skilled mechanics who are experienced and knowledgeable in waterproofing and air barrier application, and familiar with the requirements of the specified work.
 3. Provide the proper equipment, manpower and supervision on the job-site to install the system in compliance with manufacturer's published inspections and repairs and the project plans and specifications.
- C. Regulatory Compliance:
1. Primary Air Barrier and joint treatment reinforcement materials:
 - a. Listed by MBC 2015 edition and recognized for use on all types of construction.
 - b. Comply with air barrier material requirements of Ashrae 90.1-2013 and Ashrae 198.1 - 2009.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90°F. Store away from direct sunlight.

1.7 PROJECT / SITE CONDITIONS

- A. Maintain ambient and surface temperatures above 40°F during application and drying period, minimum 24 hours after application of waterproofing/air barrier.
- B. Provide supplementary heat for installation in temperatures less than 40°F or if surface temperature is likely to fall below 40°F.
- C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.8 COORDINATION / SCHEDULING

- A. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.
- B. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.
- C. Provide sill flashing to direct water to the exterior before windows and doors are installed.
- D. Install window and door head flashing immediately after windows and doors are installed.
- E. Install diverter flashings wherever water can enter the assembly to direct water to the exterior.
- F. Install parapet cap flashing and similar flashing at copings and sills to prevent water entry into the wall assembly.
- G. Install cladding within 180 days of air and moisture barrier installation.

1.9 WARRANTY

- A. Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Sto Corporation
- B. Substitutions: Permitted with prior written approval.

2.2 WATERPROOFING / AIR BARRIER

- A. Primary Air Barrier Material: Equal Guard with Sto emerald coat – ready mixed flexible spray or roller applied air and moisture barrier material.
- B. Accessory Materials:
 - 1. Sheathing Joint Treatments: Equal to Sto gold fill Sto guard mesh: Ready mixed coating applied by trowel or knife over nominal 4.2 oz/yd² self – adhesive, flexible, symmetrical, interlaced glass fiber mesh.
 - 2. Rough Opening Treatments: Sto gold fill with Sto guard mesh: Ready mixed coating applied by trowel or knife with nominal 4.2oz/yd² self-adhesive, flexible, symmetrical, interlaced, glass fiber mesh. Also used as a detail component for shingle at transitions at flashing.
 - 3. Transition Membrane:
 - a. Transition Membrane: Flexible air barrier membrane for continuity at transitions: sheathing to foundation, dissimilar materials (CMU to frame wall), wall to balcony floor slab or ceiling, flashing shingle lap transitions, floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction.
 - b. One component gun-applied air and moisture barrier membrane material for continuity at static transitions such as: flashing shingle laps, wall to balcony floor slab or ceiling, and through wall penetrations such as pipes, electrical boxes, and scupper penetrations.
 - 4. Sealant
 - a. One component rapid drying air and moisture barrier membrane materials for sealing fish mouths, wrinkles, seams, gaps, holes, or other voids in air barrier materials.
 - 5. Primers: Rubber resin emulsion primer for use with tape to enhance adhesion.

PART 3 EXECUTION

3.1 EXAMINATION

3.2 SURFACE PREPARATION

- A. Remove surface contaminants and replace damaged sheathing.
- B. Spot surface defects in sheathing with joint treatment.
- C. Repair cracks, spalls, or other damage in concrete or concrete masonry surfaces.

3.3 INSTALLATION

- A. Inspect sheathing application for compliance: Exposure 1 wood-based sheathing: E3ov – 2007. Engineered wood construction guide, and the requirements of the applicable building code.
 - 1. Glass mat faced gypsum sheathing - Georgia Pacific Publication 102250
- B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and moisture barrier installation. Do not start work until deviations are corrected.

3.2 SURFACE PREPARATION

- A. Remove surface contaminants and replace damaged sheathing.
- B. Spot surface defects in such as over driven fasteners, knot holes, or other voids. sheathing with joint treatment.
- C. Spot fasteners with knife grade or coating joint treatment material.

3.3 INSTALLATION

- A. Coordinate work with other trades to ensure air barrier continuity with connections at foundation, floor lines, flashings, lintels and shelf angles, openings and penetrations such as pipes, vents, windows and doors, masonry anchors, rafters or beams, joints in construction, projections such as decks and balconies, and roof line.
- B. Transition Membrane Detailing: Detail transition areas with Transition Membrane to achieve air barrier continuity. For illustrations or installation, including complex geometries such as inside and outside corners, refer to manufacturers details and transition membrane installation guide.
- C. Floor line deflection joints up to 1-inch wide, static joints and transitions – sheathing to foundation, dissimilar materials (CMU to frame wall), flashing shingle lap transitions, wall to balcony floor slab ceiling.
 - 1. Apply air and moisture barrier coating liberally to properly prepared surfaces with brush, roller or spray.
 - 2. Place pre-cut lengths of Transition Membrane centered over the transition in the wet coating. At changes in plane crease the membrane and similarly place the membrane material in the wet coating.

3. Immediately top coat the membrane with additional coating and apply pressure with brush roller to fully embed the membrane in the coating and achieve a smooth and wrinkle – free surface without gaps or voids.
 4. Apply coating liberally along all top horizontal edges on walls and along all edges on balcony floor slabs to fully seal the edges.
 5. Overlap minimum 2 inches at ends and adhere lap seams together with coating. Shingle lap vertical seams and vertical to horizontal intersections with minimum 2-inch overlap.
- D. Movement joints up to 1 inch wide and up to + 50% movement: through wall joints in frame construction.
1. Insert backer rod sized to friction fit in joint (diameter 25% greater than joint width).
 2. Recess the backer rod ½ “
 3. Apply the waterproof coating liberally to properly prepared surfaces with brush, roller, or spray along each side of the joint (not in the joint).
 4. Immediately place the membrane by looping it into the joint against the backer rod surface to provide slack.
 5. Embed the membrane in the wet coating along the sides of the joint by top coating with additional coating material and applying pressure with a brush or roller.
- E. After the membrane installation is complete and the air and moisture barrier coating is dry:
1. Apply a final liberal coat of the coating to all top horizontal edges on walls to ensure waterproofing integrity. Similarly apply coating at all edges on balcony floor slabs.
 2. Inspect the installed membrane for fish mouths, wrinkles, gaps, holes or other deficiencies. Correct fish mouths or wrinkles by cutting, then embedding the area with additional coating applied under and over the membrane.
 3. Seal gaps, holes, and complex geometries at three dimensional corners per manufacturer recommendations.
- F. Rough opening protection:
1. Install rough opening protection. Refer to manufacturer details.
- G. Sheathing Joints
1. Install joint treatment material with applicable reinforcement over sheathing joints. Refer to manufacturer details and applicable product bulletins.
- H. Air and Moisture barrier coating
1. Sheathing
 - a. OSB Sheathing: Install one coat of Sto Emerald Coat by spray or roller in a uniform, continuous film of 10 wet mills to the prepared substrate and to a void and pinhole free surface. Inspect surface and touch – up with a second coat at raised wood strands. Do not install over working or moving joint sealants.

3.4 FIELD QUALITY CONTROL

- A. Installer shall use a qualified testing agency or building consultant shall perform inspections and tests.

- B. Inspections: Air barrier materials are subject to inspection to verify compliance with requirements.
 - 1. Condition of substrates and substrate preparation
 - 2. Installation of primary air barrier material, accessory materials and compatible auxiliary materials over structurally sound substrates and in conformance with architectural design details, contractors shop drawings, and manufacturers written installation instructions.
- C. Tests: Air barrier material, accessory materials, and compatible with performance requirements:
 - 1. Qualitative air leakage test: ASTM E 1186
 - 2. Qualitative air leakage test: ASTM e 779, E 783, and E 1827
 - 3. Adhesion test: ASTM D 4541
 - 4. Qualitative adhesion and compatibility testing: wet sealant manufacturers field quality control adhesion test.
- D. Repair non-conforming substrates and air barrier material installation to conform with project requirements
- E. Take corrective action to repair and replace, reinstall, seal openings, gaps, or other sources of air leakage to conform with project performance requirements.

3.5 PROTECTION AND CLEANING

- A. Protect air barrier materials from damage during construction caused by wind, rain, freezing., continuous high humidity, or prolonged exposure to sun light.
- B. Protect air barrier materials for damaged from trades, vandals, and water infiltration during construction.
- C. Repair damage materials to meet project specification requirements.
- D. Clean spills, stains, soiling form finishes or other construction materials that will be exposed in the completed work with compatible cleaners.
- E. Remove all masking materials after work is completed.

END OF SECTION

SECTION 07311
ASPHALT SHINGLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphalt shingles.
 - 2. Ice dam membrane.
 - 3. Underlayment.
 - 4. Valley protection.
 - 5. Ridge vents.
 - 6. Metal flashings and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data indicating material characteristics, and limitations.
- B. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color and texture selection.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with NRCA Steep Roofing Manual.
- B. Roof Covering Fire Classification: Minimum Class A when tested in accordance with ASTM E108 or UL 790.
- C. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install ice dam membrane and shingles when surface, ambient air or wind chill temperatures are below 45 degrees F.

1.5 WARRANTY

- A. Furnish 30 year manufacturer warranty for asphalt shingles.

PART 2 PRODUCTS

- A. Manufacturers:
 - 1. Certain Teed Corporation Model Landmark TL.
 - 2. Substitutions: Permitted.
- B. Asphalt Shingles: ASTM D3462; glass fiber mat base, mineral granule surface type; 340 lb/100 sq ft weight; self sealing type; laminated overlay type; color and texture as selected.
 - 1. Tear Resistance: Meeting ASTM D3462.
 - 2. Fire Resistance: UL Class A, Type I, meeting ASTM 3018.
 - 3. Wind Resistance: ASTM D3161, Class F, 110 MPH wind resistance.

4. Wind Driven Rain: Miami Dade Product control acceptance.

2.2 COMPONENTS

- A. Ice Dam Membrane: ASTM D1970; self adhering polymer modified bituminous sheet material, slip resistant surface, 40 mils thick, 36 inches wide, with strippable release paper to expose adhesive surface.
- B. Underlayment: ASTM D226; Type II, No. 30 unperforated asphalt felt.

2.3 RIDGE, HIP, AND EAVE VENTS

- A. Ridge and Hip Vents: Plastic, nominal 14 inches wide with vent openings that do not permit direct water or weather entry; to receive cap shingles; minimum 18 sq inches/foot net free area.
- B. Starter and End Caps: As required to suit application.

2.4 ACCESSORIES

- A. Nails: ASTM F1667; standard round wire roofing nails hot dipped galvanized steel type, minimum 0.105 inch diameter shank, minimum 0.375 inch diameter head; of sufficient length to penetrate through roof sheathing.
- B. Plastic Cement: ASTM D4586, Asphalt type with mineral fiber components, free of toxic solvents, capable of setting within 24 hours at temperatures of 75 degrees F and 50 percent RH.
- C. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.
- D. Flashing Materials:
 1. Sheet Flashings: As specified in Section 07620.
 2. Pre-Finished Aluminum Sheet: ASTM B209 alloy and temper as required for application and finish; 0.032 inch thick; plain finish shop pre-coated with three coat fluoropolymer top coat; color as selected from manufacturer's standard.
- E. Bituminous Paint: Acid and alkali resistant type; black color.

2.5 FABRICATION

- A. Form flashings to protect roofing materials from physical damage and shed water.
- B. Form eave edge and gable edge flashing to extend minimum 2 inches onto roof and minimum 0.25 inches below sheathing.
- C. Form flashing sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
- D. Hem exposed edges of flashings minimum 1/4 inch on underside.
- E. Apply bituminous paint on concealed surfaces of flashings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof penetrations and plumbing stacks are in place and flashed to deck surface.
- B. Verify roof openings are correctly framed.
- C. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.2 PREPARATION

- A. Fill knot holes and surface cracks with latex filler at areas of bonded ice dam membrane.
- B. Broom clean deck surfaces under ice dam membrane and underlayment.

3.3 INSTALLATION

A. Ice Dam Membrane Installation:

1. Place eave edge and gable edge metal flashings tight with fascia boards. Weather lap joints minimum 2 inches and seal with plastic cement. Secure flange with
2. Install ice dam membrane parallel with eave edge, flush with face of eave edge flashing with edges lapped shingle style and ends lapped and staggered between rows.
3. Apply 4 inch wide band of plastic cement over deck flange of eave edge flashings, and embed minimum 19 inch wide strip of ice dam membrane. Place underlayment starter strip with eave edge flush with face of flashings. Secure in place. Lap ends minimum 6 inches.
4. Apply lap cement at rate of approximately 1 ¼ gal/100 sq ft over starter strip.
5. Starting from lower edge of starter strip, lay additional 36 inch wide strips of ice dam membrane in lap cement, to produce two ply membrane. Weather lap plies minimum 19 inches and nail in place. Lap ends minimum 6 inches. Stagger end joints of each consecutive ply.
6. Extend ice dam membrane minimum 4 ft up-slope beyond interior face of exterior wall.

B. Underlayment Installation:

1. Place 19 inch wide ply of underlayment over substrate not covered by ice dam membrane, with ends lapped minimum 2 inches. Weather lap ice dam membrane minimum 2 inches. Nail underlayment in place.
2. Place second ply of underlayment over first layer, lapping first layer 19 inches. Lap ends minimum 2 inches. Stagger end laps of each consecutive layer. Nail underlayment in place.
3. Install underlayment in accordance with manufacturer's instructions. Nail underlayment overlap at 36 inches on center.
4. Weather lap and seal items projecting through or mounted on roof watertight with plastic cement.

C. Valley Protection Installation:

1. Ice Dam Membrane - Open Valleys:
 - a. Place ice dam membrane sheet, 36 inches wide, each side of valley and lap center seam and seal.
 - b. Place sheet metal flashing with crimp.

D. Metal Flashing and Accessories Installation:

1. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
2. Secure in place with nails. Conceal fastenings.

3. Flash and seal Work weather tight, projecting through or mounted on roofing with plastic cement.
- E. Asphalt Shingles Installation:
1. Place shingles in straight coursing pattern with 5 inch weather exposure to produce triple thickness over full roof area.
 2. Project first course of shingles 3/4 inch beyond fascia boards.
 3. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
 4. Extend shingles on both slopes across valley in weave pattern and fasten. Extend shingles minimum of 12 inches beyond valley center line to achieve woven valley, concealing valley protection.
 5. Cap hips and ridges with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.
 6. After installation, place two daubs of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.
 7. Install ridge vents centered over ridge.
 8. Cap hips and ridges with individual shingles. Place to avoid exposed nails.
 9. Coordinate installation of roof mounted components or Work projecting through roof with weather tight placement of Counterflashings.
 10. Complete installation to provide weather tight service.

END OF SECTION

SECTION 07468

METAL SIDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes preformed metal siding system for walls, and soffits, with related flashings and accessory components.
 - 1. Provide building paper back-up over sheathed walls.

1.2 PERFORMANCE REQUIREMENTS

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.
- B. Maximum Allowable Deflection of Panel: 1/180 of span.
- C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.
- D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- E. Products: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials.
- F. Vapor Retarder: Provide continuity of vapor retarder at building enclosure elements in conjunction with vapor retarders.
- G. Air Seal: Provide continuity of air barrier seal at building enclosure elements in conjunction with air seal materials.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.
- B. Product Data: Submit data on panels.
- C. Samples: Submit two samples of siding, siding finish, 6 x 6-inch in size illustrating finish color, sheen, and texture.
- D. Manufacturer's Installation Instructions: Submit special procedures.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials capable of causing discoloration or staining.

1.6 COORDINATION

- A. Coordinate Work for installation of vapor retarder and air barrier seals.
- B. Coordinate Work with installation of windows adjacent components or materials.

PART 2 PRODUCTS

2.1 MANUFACTURED METAL SIDING AND SOFFIT

- A. Manufacturers:
 - 1. PAC Clad.
 - 2. Substitutions: Approved equal.

2.2 COMPONENTS

- A. Exterior Composite Wall Panel: 12" flush panel with two pencil ribs, 1" depth, 24 guage steel, prefinished, rounded interlock leg, vertical. Corners inside and outside, sill and top edge trim.
- B. Miscellaneous Sheet Materials: Minimum 20 gage thick steel stock or 0.040-inch-thick aluminum stock
 - 1. Galvanized Steel: ASTM A924/A924M, Grade D, Coating Designation G90. Precoated Surfaces: Color as selected from manufacturer's standard range.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; brake formed to required angles. Mitered internal corners to be back braced with 22 gage thick pre-coated sheet stock to maintain continuity of profile.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile to suit system. Exposed fasteners same finish as panel system.
- E. Trim, Closure Pieces, Caps, Flashings, Fascias: Same material, thickness and finish as exterior sheets; brake formed to required profiles. Coping: ATAS Rapid-LokUltra.
- F. Anchors: Type as recommended by panel manufacturer.

2.3 METRL SOFFIT

- A. Exterior Soffit Panel: 12" flush panel, 1" depth, 24 guage steel, prefinished, rounded interlock leg, with trim closures.

2.4 ACCESSORIES

- A. Sealants: Specified in Section 07900. Color to match siding.
- B. Fasteners: Manufacturer's standard type to suit application; fastener cap same color as exterior panel. Exposed fasteners same finish as panel system.
- C. Power Actuated Fasteners: Steel, hot dip galvanized; fastener cap same color as exterior panel.
- D. Field Touch-up Paint: As recommended by panel manufacturer.
- E. Bituminous Paint: Asphalt base.
- F. Ice and Water Shield: 18-inch-wide roll, self-adhering sheet comprised of rubberized asphalt adhesive backed by a layer of high density cross laminated polyethylene and a foldless release paper. Equal to Grace Ice and Water Shield.

2.5 FABRICATION

- A. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest practicable lengths.
- C. Panel Profile: Manufacturer's standard profile for specified system.
- D. Fabricate corners in one continuous piece with minimum 18-inch returns.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify building framing members are ready to receive panel system.

3.2 INSTALLATION - ICE AND WATER SHIELD

- A. Install 1-layer building paper horizontally on walls to receive metal siding.
- B. Weather lap edges 6 inches and ends minimum 6 inches, minimum.
- C. Stagger vertical joints of each layer.
- D. Secure in place.

3.3 INSTALLATION

- A. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- B. Fasten siding to structural supports; aligned, level, and plumb.
- C. Locate joints over supports. Lap panel ends minimum 2 inches.
- D. Install expansion joints.
- E. Use concealed fasteners unless otherwise approved by Architect/Engineer.
- F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 ERECTION TOLERANCES

- A. Maximum Offset from Indicated Alignment between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/8 inch.

3.5 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07530

ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Elastomeric Sheet Membrane Conventional Roofing System with vapor retarder, insulation, roofing membrane expansion joints, mechanically attached.

1.2 SUBMITTALS

- A. Prior to starting work, the roofing contractor shall submit the following:
 - 1. Setting plan for tapered insulation layout, and conditions of interface with other materials.
 - 2. Indicate membrane layout and seam locations.
 - 3. Submit a letter of certification from roofing manufacture which certifies the contractor is authorized to install the roofing system and list the foreman who received training from the manufacturer along with the dates the training was received.
 - 4. Certification that the membrane thickness is as specified and has a minimum of 15 Mil to ply membrane over reinforcing.
- B. Product Data: Submit characteristics on membrane materials, flashing materials and insulation.
- C. Upon completion of work submit copies of the manufactures final inspection indicating to many defencies have been corrected list of maintenance items and recommended period dates to per and manufacture warranty.

1.3 QUALITY ASSURANCE

- A. The Membrane Roofing System must achieve a UL Class A UL 790. Foam insulation & roof assembly shall pass UL1256.
- B. The specified roofing assembly must be rated by Factory Mutual Global (FMG) to meet exceed the factored uplift pressures outlined in FMG Property Loss Prevention Data Sheet 1-28 and complies with FMG Property Loss Prevention Data Sheet 1-29 for enhancements at the perimeter and corners.
- C. The membrane must be manufactured by the material supplier. Manufacturers supplying membrane made by others are acceptable.
- D. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturers current specifications and details.

- E. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having a least five (5) years successful experience installing single-ply TPO roofing systems and having installed at least one (1) roofing application or several similar systems of equal or greater size within one year.
- F. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent in the job at all times roofing work is in progress.
- G. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the specifier. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the specifier's consideration.
- H. The TPO White membrane meets CRRC (Cool Roof Rating Council) for reflectance and emittance. When tested in accordance with ASTM C15549, the Sure-Weld White material has an initial solar reflectance of 0.79 and a 3-year aged reflectance of 0.70. The material has also been tested for emittance in accordance with ASTM C1371 an initial emittance of 0.90 and a 3-year aged emittance of 0.86 were achieved.
- I. Roof Assembly Fire Classification: Minimum Class A when tested in accordance with ASTM E108 or UL 790.
 - 1. Roof Assembly with Foam Insulation: Passes FM 4450 or UL 1256.
- J. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 255.
- K. Apply label from agency approved by authority having jurisdiction to identify each roof assembly component.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.
- B. Comply with the manufacturer's written instructions for proper material storage.
 - 1. Store membrane in the original undisturbed plastic wrap in a cool, shaded area. Membrane that has been exposed to the elements for approximately 7 days must be prepared with Weathered Membrane Cleaner prior to hot air welding.
 - 2. Store curable materials (adhesives and sealants) between 60 F and 80 F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60 F minimum temperature before using.
 - 3. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.

- C. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.
- D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

1.5 WARRANTY

- A. Provide manufacturers 20-year total system warranty covering both labor and material with no dollar limitation. The maximum wind speed coverage shall be 110 mph measured at 30 feet above ground level.
- B. Pro-rated warranties shall not be accepted.
- C. Warranty shall also cover leaks caused by hail up to 1-inch diameter and is installed over a recovery board or dens deck prime.
- D. Evidence of the manufacturer's warranty reserve shall be included as part of project submittals.

PART 2 PRODUCTS

2.1 ELASTOMERIC ROOF MEMBRANES

- A. Manufacturers:
 - 1. Carlisle SynTec Systems.
 - 2. Firestone Building Products Co.
 - 3. Johns Manville.
 - 4. Silka Sarnafil, Inc.

2.2 COMPONENTS

- A. Membrane: ASTM D4434; Type IV TPO (thermoplastic Polyolefin) reinforced, 0.60 mil thick, 8ft wide roll; white color; membrane thickness over the reinforcing scrim (top-ply thickness) nominal 15 mil thick or greater.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Insulation Materials:
 - 1. Insulation: ASTM C1289 type II, class, faced rigid cellular polyisocyanurate roof insulation, with the following characteristics:
 - a. Board Density: 25 lb./cu ft.
 - b. Board Size: 48 x 96-inch, 48 x 48-inch tapered
 - c. Board Thickness: Tapered and 1-1/2-inch
 - d. Board Edges: square.
- D. Dens Deck Prime: Gypsum core that incorporates glass-mat facing on the top and bottom side. The top surface is pre-primed and provides excellent bond strength for adhered membrane for use as a cover board, thickness 1/2-inch 48 x 96-inch size square edge.

2.3 ACCESSORIES

- A. Membrane Fastening:
 - 1. Membrane Adhesive: As recommended by membrane manufacturer.
 - 2. Insulation Adhesive: As recommended by insulation manufacturer.
 - 3. Disc Washers and Screws: Manufacturer Recommendation.
 - 4. Partial Adhesive Washer Disc: Membrane material.
- B. Insulation Adhesive: As recommended by insulation manufacturer.
- C. Insulation Joint Tape: As recommended by Insulation Manufacturer.
- D. Dry Sheathing Paper: Clean, white cellulose paper.
- E. Flexible Flashings: Same material as membrane; white color.
- F. Roofing Nails: Galvanized, hot dipped type.
- G. Sealants: As recommended by membrane manufacturer.
- H. Walkway Pads: 24 x 24-inches.
- I. Termination Bars: A 1-inch-wide x 0.98-inch-thick extruded aluminum bar pre punched 6" on center with a sealant ledge to support lap sealant.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify surfaces and site conditions are ready to receive Work; deck is clean and smooth, free of snow or ice; properly sloped to drains.
- B. Verify roof openings, curbs, and protrusions through roof are solidly set; and reglets are in place.

3.2 INSULATION APPLICATION

- A. Insulation Application:
 - 1. Embed into insulation adhesive and mechanically fasten insulation to deck.
 - 2. Mechanically fasten first layer of insulation to deck. Embed into insulation adhesive, second layer of insulation. Lay second layer of insulation with joints staggered from first layer. Both horizontally and vertically.
 - 3. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
 - 4. Tape joints of insulation.
- B. Cover Board application: Adherer
 - 1. Mechanically fasten cover board to deck per manufacturer's instructions lay cover boards with edge in moderate contact without forcing cut cover boards to perimeter blocking and around penetrations.
 - 2. Tape Joints

3.3 MEMBRANE INSTALLATION

- A. Position membrane over cover board. Fold membrane sheet back onto itself so half the underside is exposed.
- B. Apply bonding adhesive in accordance with manufacturer's published instructions to the exposed underside of the membrane and the corresponding substrate area. Do not apply bonding adhesive along the splice edge of the membrane to hot air welded owner the adjoining sheet. Allow adhesive to dry until it is tacky but will not string to a dry touch finger.
 - 1. Roll the coated membrane into the coated substrate free from air pockets, wrinkles, and tears.
 - 2. Fold back the unbounded half of the sheet and repeat the bonding procedures.
- C. Continue to install adjoining membrane sheets in same manor, overlapping edges a minimum of 2 inches.
- D. Hot -air weld membrane seams in accordance with the manufacturer's specifications using either hot air welding machine or hot air hand welder. At all splice intersections, roll the seam with a silicone roller immediately welder crossed the membrane step off to ensure a continuous hot air welded seam.
 - 1. All splice intersections shall be overlaid with joint covers or non-reinforced flashing.
- E. Probe all seams once the air welds have thoroughly cooled. Repair deficiencies the same day the are discovered.
- F. Apply cut edge sealant on all cut edge of reinforced membrane where the scrim reinforcement is exposed.
- G. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane. Non-reinforced membrane may be used for the flashing pipe penetration sealant pockets.
 - 1. Use prefabrication accessories at all areas except when their use is not feasible.
 - 2. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edge coping and roof drain.
- H. Install walkway pads at all locations indicated on drawings.
 - 1. Hot air weld walkway pad to the membrane in accordance with the 4 manufacturer's instructions.

3.4 DAILY SEAL

- A. Provide temporary seal when the completion of flashings and terminations are not achieved by the end of the workday, the seal must be prepared to temporarily close the membrane to prevent water infliction.

3.5 CLEAN UP

- A. Perform daily clean to collect all wrappings, empty containers, and debris from project site, dispose of all debris.
- B. Perform pre-inspection to review all work and to verify flashings have been installed with all caulking, and provide to manufacturer's warranty inspector, correct any deficiencies.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes flashings and counter flashings, downspouts, gutters, and fabricated sheet metal items.
- B. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, termination, and installation details.

1.3 WARRANTY

- A. Furnish five-year manufacturer warranty for finishes.

PART 2 PRODUCTS

2.1 ROOF EDGING SYSTEM

- A. Econosnap: Decorative metal fascia with continuous galvanized steel spring cant to terminate single-ply roofing at perimeter. They system shall be watertight with concealed splice plates and no exposed fasteners.
- B. Performance characteristics:
 - 1. Roof edging shall lock membranes, preventing wind pullback.
 - 2. Fascia shall freely thermal cycle on spring ant substrate, preventing periodic maintenance.
 - 3. Fascia may be factory modified for true radius application.
- C. Fascia metal gauge: .050", thick formed aluminum; with Kynar 500 finish.
- D. Fascia: Std. 10'-0" lengths with matching concealed joint splice plates.
- E. Spring cant: Shall be continuous 24 gauge commercial type G90 galvanized steel at 10'-0" standard lengths.
- F. Fasteners: Stainless steel 1-1/2-inch ring shank nails as provided by the manufacturer. No exposed fasteners permitted.
- G. Exterior Fascia Finishes: Kynar-500 from manufacturer's standard colors.
- H. Corners, fascia sumps, spill outs, etc. shall be fabricated by the gravel stop manufacturer. Factory fabricated, mitered corners shall have 12" nominal leg lengths.

2.2 PARAPET COPING SYSTEM

- A. Permasnap Coping: Metal coping cap with galvanized steel anchor cleats and gutter support chairs for capping any parapet wall. The system shall be watertight, maintenance free, and not require exposed fasteners or sealant. Joints shall be butt type with concealed splice plates.
- B. Performance characteristics:
 - 1. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
 - 2. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
 - 3. All coping cover joints shall be underplayed with gutter/support chairs capable of draining water.
- C. Metal: 24-gauge galvanized steel with Kynar coating.
- D. Coping cap: Length of 10'-0"; custom widths as indicated on drawings.
- E. Coping vertical face and back leg: standard 4" nominal.
- F. Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.
- G. Coping Cleat: 20-gauge galvanized steel anchor cleat; normally 16" wide at 5'-0" on center to be mechanically fastened.

2.3 GUTTERY DOWNSPOUTS

- A. Gutters: Prefinished metal, 24 gauge 6" width and 6" depth, box type profile.
- B. Downspouts: Prefinished metal, 24 gauge, 4 x 4-inch.
- C. Gutter/support chair: Metal Gutter Chair in color and finish to match coping cap.
- D. Fasteners: Shall be stainless steel screw type with a minimum pull-out resistance of 240# as supplied by the manufacturer per substrate supplication. No exposed fasteners shall be permitted.
- E. Finishes: Shall be standard post coated Kynar-500 from industry standard two coat colors. Color shall be as selected.
- F. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer.
- G. Welded or METAL-LOCK R assembly shall be used to maintain watertight integrity.

2.4 COMPONENTS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M; structural steel sheet, G90 zinc coating; 0.024-inch-thick core steel, shop pre-coated with polyester acrylic two coat fluoropolymer topcoat; color as selected from manufacturer's standard color.

2.5 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Downspout and Downspout Anchorage Devices: Formed prefinished galvanized steel. Shape as indicated on drawings recommended by fabricator.
- C. Downspout Supports: Brackets or straps.
- D. Underlayment: ASTM D226; Type II, No. 30 unperforated asphalt felt.
- E. Protective Backing Paint: Zinc molybdate alkyd.
- F. Slip Sheet: Rosin sized building paper.
- G. Sealant: Exterior metal lap joint butyl or polyisobutylene sealant as specified in Section 07900.
- H. Plastic Cement: ASTM D4586, Type I.
- I. Reglets: Recessed galvanized steel face and ends covered with plastic tape.

2.6 FABRICATION

- A. Downspout Boots: Plastic.
- B. Form components to shape indicated on Drawings, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.
- C. Fabricate cleats and starter strips of same material as sheet, to interlock with sheet.
- D. Hem exposed edges on underside 1/2 inch; miter and seam corners. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- E. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.
- F. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- G. Fabricate corners in one piece, 18-inch-long legs; seam for rigidity, seal with sealant.
- H. Form sheet metal pans with upstand, and flanges.

2.7 SHOP FINISHING

- A. Polyester coating: Baked enamel system conforming to AAMA 2603.
- B. Fluoropolymer Coating: Multiple coat as specified for sheet metal system, thermally cured, conforming to AAMA 2604.
- C. Washcoat: Finish concealed side of metal sheets with washcoat compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.
- C. Verify that the roof edging installation will not disrupt other trades. Verify that the substrate is dry, clean and free of foreign matter. Report and correct defects prior to any installation.

3.2 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Install starter and edge strips, and cleats.
- B. Install surface mounted reglets. Seal top of reglets with sealant. Insert flashings to form tight fit. Seal flashings into reglets with sealant.
- C. Secure flashings, gutters and downspouts in place using [concealed] fasteners.
- D. Apply plastic cement compound between metal work and felt flashings.
- E. Fit components tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Connect downspouts to downspout boots storm sewer system. Seal connection watertight.
- G. Set splash pads under downspouts.
- H. Seal joints watertight.

3.4 INSTALLATION ECONOSNAP ROOF EDGING SYSTEM

- A. Submit product design drawings for review and approval to Architect or Specifier before fabrication.
- B. Installing contractor shall check as-built conditions and verify the manufacturer's gravel stop details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the roof edging manufacturer's installation guide when setting edging.
- C. Roofing membrane must be single ply; not to exceed 60 mils thick.
- D. Installer shall use stainless steel fasteners as supplied by manufacturer minimum length 1 ½" suitable for the substrate to which being installed.

3.5 INSTALLATION

- A. Submit product design drawings for review and approval to Architect or Specifier before fabrication.
- B. Installing contractor shall check as-built conditions and verify the manufacturer's coping details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the coping manufacturer's installation guide when setting coping.
- C. Installer shall use mechanical fasteners with minimum 240# pull-out resistance suitable for parapet substrates.

END OF SECTION

SECTION 07710

ROOF EDGING/FASCIA

PART 1 – GENERAL

1.1 SUMMARY

- A. Work included: Furnishing and installing factory fabricated and finished roof edging.

1.1 SUBMITTALS

- A. Product Data: Provide manufacturer's product and complete installation data for all materials in this specification.
- B. Shop drawings: Show profiles, joining method, location of accessory items, anchorage and flashing details, adjacent construction interface, and dimensions.
- C. Samples: Available on request; sized to adequately represent material.
- D. Contract Closeout: Submit Special Warranty and Manufacturer's performance certifications.
- E. Installation Guide: The product manufacturer shall provide a written installation guide.

1.4 QUALITY ASSURANCE:

- A. High performance roof edge shall be CERTIFIED by the manufacturer to comply with ANSI/SPRI Standard ES-1. Roof edge/gravelstop shall meet performance design criteria according to the following test standards:
 - 1. ANSI/SPRI ES-1 Test Method RE-1 Test for Roof Edge Termination of Single-ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum 100 lbs/ft in accord with the ANSI/SPRI ES-1 Test Method RE-1. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
 - 2. ANSI/SPRI ES-1 Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1 Test Method RE-2. Use the current edition of ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
 - 3. The roof edge product shall be UL Classified by Underwriters Laboratories, Inc.® or other 3rd party verification of compliance with the ANSI/SPRI ES-1 Wind Design Standard.

1.5 PRODUCT HANDLING:

- A. All materials shall be delivered in the manufacturer's original sealed, labeled containers.
- B. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective plastic surface film after installation.

1.6 JOB CONDITIONS

- A. Verify that other trades are complete before installing the roof edging.
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane manufacturer's installation instructions.
- E. Observe all appropriate OSHA safety guidelines for this work.

1.7 WARRANTY/GUARANTEE

- A. Manufacturer's Standard Warranty: Warranted materials shall be free of defects in material and workmanship for five years after shipment. If, after inspection, the manufacturer agrees that materials are defective, the manufacturer shall at their option repair or replace them. For decorative finish warranty, consult manufacturer.
- B. Special 25-Year Category5SM Warranty: Manufacturer shall guarantee that a standard size roof edge system, when installed per manufacturer's instructions, will not blow off, leak, or cause membrane failure, even in wind conditions up to 155 mph, or the manufacturer shall replace or repair its materials.

PART 2 – PRODUCTS

2.1 MANUFACTURER:

A. W. P. Hickman Company
P.O. Box 15005
Asheville, NC 28813-0005
Phone: 828-676-1700
Toll Free: 800-892-9173
Fax: 828-676-2330
Internet address - <http://www.wph.com>

2.2 ROOF EDGING

- A. TerminEdge Roof Edging: A two-part assembly with a rigid terminator base plate, and a decorative snap-on fascia cover for single-ply roofs with raised perimeter edges. The system shall have all concealed fasteners with no penetration on horizontal roof surface. Model shall be tex 825 with retainer clip.
- B. Retainer Base Plate: Shall be 20 gauge galvanized steel with 9/32" pre-punched holes for fasteners @ 12" on center in 10'-0" standard lengths.
 - 1. Install with field-applied waterproof sealant by roofing membrane manufacturer.
- C. Exterior Fascia Covers:

1. Standard: 24 gauge galvanized steel in 10'-0" lengths for all sizes; concealed, matching 4" wide 24ga joint splice plates.

D. Fasteners: Stainless steel hex head screw type provided by the manufacturer.

E. Exterior fascia finishes: For 24 gauge galvanized steel choose] Kynar-500 standard color from manufacturer's standard colors.

2.3 PARAPET COPING

A. Coping System: "PermaSnap Premier Plus"

1. Description:
 - a. Snap-on coping with intermittent clips for capping parapet walls.
 - b. Does not require exposed fasteners or joint sealants.
2. Performance Characteristics:
 - a. Snap-on Coping Cap Sections: Capable of expanding and contracting freely, statically engaged onto mechanically secured clips.
 - b. Snap-on Coping Cap Joints: Underlaid with concealed splices.
3. Approvals
 - a. ANSI/SPRI/FM 4435 ES-1 for 4 ga./".40" – 383 psf Vertical and 221 psf Horizontal, for 22 ga./".050"/".063" – 513 psf Vertical and 297 psf Horizontal.
 - b. FM Approved with 24 ga./".040" cover – 1-225 Perimeter and 1-150 Corner, with 22 ga./".050"/".063" cover – 1-300 Perimeter and 1-195 Corner.
 - c. Florida Product Approval.
 - d. Miami-Dade County Approved.
4. Intermittent Clips:
 - a. Material: 16 ga. Galvanized steel.
 - b. Width: 12"
 - c. Fastener Holes: Pre-Punched.
5. Concealed Splices:
 - a. Material: Same as snap-on coping cap.
 - b. Finish and Color: Same as snap-on coping cap.
 - c. Width: 8"
 - d. Sealant Strips: Factory-applied dual non-curing isocryl butyl sealant strips.

2.4 ACCESSORIES

- A. Corners, end caps, fascia sumps, or spillouts, etc. shall be fabricated by the roof edging manufacturer. Factory fabricated mitered corners shall have 12-inch nominal (305 mm) leg lengths.
- B. Provide matching ledge caps, downspouts, or other special fabrications as detailed.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Verify that the roof edging installation will not disrupt other trades. Verify that the substrate is dry, clean and free of foreign matter. Report and correct defects prior to any installation.

3.2 INSTALLATION - ROOF EDGING

- A. Submit design drawings for review and approval to Architect or Specifier before fabrication.
- B. Installing contractor shall check as-built conditions and verify the manufacturer's roof edging details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the roof edging manufacturer's installation guide when setting edging.
- C. Installer shall use stainless steel screw type fasteners as provided by manufacturer, nominal 1-1/4-inch (32 mm) length, with minimum 240# (109 kg) pull-out resistance; suitable for the substrates to which being installed.
- D. Install waterproof sealant to underside of retainer base plate as recommended and supplied by the roofing membrane manufacturer.

END OF SECTION

SECTION 07723

ROOF HATCHES

PART 1 GENERAL

1.1 SUMMARY

- A. Work Included: Provide factory-fabricated roof hatch for ladder access.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
- B. Shop Drawings: Submit shop drawings, including profiles, accessories, location, adjacent construction interface, and dimensions.
- C. Warranty: Submit executed copy of manufacturer's warranty.

1.3 QUALITY ASSURANCE

- A. Manufacturer: A minimum of 5 years' experience manufacturing similar products.
- B. Installer: A minimum of 2 years' experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards, including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately, to delivery carrier and note such damage on the carrier's freight bill of lading.

PART 2 – PRODUCTS

2.1 MANUFACTURER:

- A. Basis-of-Design Manufacturer: Type GS Roof Hatch by the BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax 1-203-535-1582. Web: www.BILCO.com

2.2 ROOF HATCH

- A. Furnish and install where indicated on plans metal roof hatch Type GS, size width 36" x length: 30". Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

- B. Performance Characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 2 psf wind uplift.
 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. Operation of the cover shall not be affected by temperature.
 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- C. Cover: Shall be 11-gauge aluminum with a 3" beaded flange and a polycarbonate dome framed with rigid extruded aluminum and coated for UV resistance. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- D. Curb: Shall be 12" in height and of 14-gauge paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" flange with 7/16" holes provided for securing to the roof deck. The curb shall be equipped with an integral metal cap flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" on center, to be bent inward to hold single ply roofing membrane securely in place.
- E. Curb Insulation: Shall be rigid, high-density fiberboard of 1" thickness on outside of curb.
- F. Lifting Mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe for steel construction through bolted to the curb assembly.
- G. Hardware
1. Heavy pintle hinges shall be provided.
 2. Cover shall be equipped with a spring latch with interior and exterior push handle.
 3. Roof hatch shall be equipped with interior and exterior padlock hasps.
 4. The latch strike shall be a stamped component bolted to the curb assembly.
 5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" diameter red vinyl grip handle to permit easy release for closing.
 6. All hardware shall be zinc-plated and chromate sealed.
 7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
- H. Finishes: Factory finish shall be alkyd based red oxide primed steel.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units' level, plumb, and in proper alignment with adjacent work.
 - 1. Test units for proper function and adjust until proper operation is achieved.
 - 2. Repair finishes damaged during installation.
 - 3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes firestopping and through-penetration protection systems materials and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data on product characteristics, performance and limitation criteria.
- B. Design Data: Provide schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 255.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

- B. Maintain this minimum temperature before, during, and minimum 3 days after installation of materials.
- C. Provide ventilation in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 FIRESTOPPING

- A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 - a. Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
 - 2. Foam Firestopping Compounds: Single component foam compound.
 - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 - 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 - 6. Firestop Pillows: Formed mineral fiber pillows.
 - 7. Mortar as specified in Section 04065 where permitted by applicable code.

2.2 ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Mineral fiber matting.
 - 3. Sheet metal.
 - a. Composite Wood Products: Contain no added urea-formaldehyde resins.
 - 4. Alumina silicate fire board.
- C. Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of matter effecting bond of firestopping material.
- B. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

- A. Apply primer where recommended by manufacturer for specific material and substrate.
- B. Apply firestopping material in sufficient thickness to achieve required fire rating, to uniform density and texture.
- C. Install material at walls or partition openings containing penetrating sleeves, piping, duct work, conduit and other items, requiring firestopping.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sealants and joint backing.
- B. Refer to Division 0 and Division 1 requirements. Requirements of these divisions and project drawings shall govern work of this section.

1.2 SUBMITTALS

- A. Product Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.1 JOINT SEALERS

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. GE Silicones.
 - 3. Pecora Corp.
 - 4. Sika Corp.
 - 5. Substitutions: Permitted.
- B. Product Description:
 - 1. High Performance General Purpose Exterior (Nontraffic) Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
 - a. Type: A.
 - b. Color: Standard colors matching finished surfaces.
 - c. Applications: Use for:
 - 1) Control, expansion, and soft joints in masonry.
 - 2) Joints between concrete and other materials.
 - 3) Joints between metal frames and other materials.
 - 4) Other exterior nontraffic joints for which no other sealant is indicated.
 - 2. General Purpose Traffic Bearing Sealant: Polyurethane; ASTM C920, Grade P, Class 25, Use T; single component.
 - a. Type: B.
 - b. Color: Standard colors matching finished surfaces.
 - c. Applications: Use for exterior vehicular traffic bearing joints.
 - 3. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
 - a. Type: C.

- b. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.
- 4. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
 - a. Type: D.
 - b. Color: Standard colors matching finished surfaces.
 - c. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
- 5. Acoustical Sealant: Butyl or acrylic sealant; ASTM C920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
 - a. Type: F.
 - b. Applications: Use for concealed locations only at acoustically rated construction.
 - 1) Provide sealant bead between top stud runner and structure and between bottom stud track and floor.
- 6. Sealant - Butyl Sealant: ASTM C920, Grade NS, Class 12-1/2, Use NT; single component, solvent release, non-skinning, non-sagging.
 - a. Type: G.
 - b. Color: Black.
 - c. Movement Capability: Plus and minus 12-1/2 percent.
 - d. Service Temperature Range: -13 to 180 degrees F.
 - e. Shore A Hardness Range: 10 to 30.
- 7. Sealant - Non-sag Polyurethane Sealant: ASTM C920, Grade NS, Class 25, Uses NT, M; single component, chemical curing, non-staining, non-bleeding, non-sagging type.
 - a. Type: H.
 - b. Color: Standard colors matching finished surfaces.
 - c. Movement Capability: Plus and minus 25 percent.
 - d. Service Temperature Range: -40 to 180 degrees F.
 - e. Shore A Hardness Range: 20 to 35.
- 8. Sealant - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Class 25, Uses T, M, A; single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, self-leveling type.
 - a. Type: I.
 - b. Color: Standard color matching finished surfaces.
 - c. Movement Capability: Plus and minus 25 percent.
 - d. Service Temperature Range: -40 to 180 degrees F.
 - e. Shore A Hardness Range: 20 to 35.

2.2 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces and joint openings are ready to receive work.
- B. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

- A. Remove loose materials and foreign matter impairing adhesion of sealant.
- B. Clean and prime joints.
- C. Perform preparation in accordance with ASTM C1193.

3.3 INSTALLATION

- A. Perform installation in accordance with ASTM C1193.
- B. Perform acoustical sealant application work in accordance with ASTM C919.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.

3.4 SCHEDULE

- A. Exterior Joints for Which No Other Sealant Type is Indicated: Type A.
- B. Control and Expansion Joints in Paving: Type B.
- C. Exterior Wall Expansion Joints: Type A.
- D. Control, Expansion, and Soft Joints in Masonry, and Between Masonry and Adjacent Work: Type A.
- E. Lap Joints in Exterior Sheet Metal Work: Type C.
- F. Butt Joints in Exterior Metal Work and Siding: Type C.
- G. Joints between Exterior Metal Frames and Adjacent Work (except masonry): Type H.
- H. Under Exterior Door Thresholds: Type G.
- I. Interior Joints for Which No Other Sealant is Indicated: Type D.

- J. Control and Expansion Joints in Interior Concrete Slabs and Floors: Type I.
- K. Joints Between Plumbing Fixtures and Walls and Floors, and Between Counter tops and Walls: Type E.
- L. In STC-Rated Walls, Between Metal Stud Track/Runner and Adjacent Construction, Between Outlet Boxes and Gypsum Board: Type F.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes steel doors and frames; non-rated and fire rated, interior borrowed light frames.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, cut-outs for glazing.
- B. Product Data: Submit door and frame configurations, location of cut-outs for hardware reinforcement.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. ANSI 250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
 - 3. NFPA-101 - Life Safety Code.
 - 4. Michigan Building Code 2009.
 - 5. ANSI A117.1 - Accessible and Useable Buildings and Facilities.
 - 6. ADA - Americans with Disabilities Act.
 - 7. NFPA 80 - Fire Doors and Windows.
 - 8. SDI-107 - Hardware on Steel Doors.
 - 9. ANSI A250.4 - Steel Doors and Frames Physical Endurance.
 - 10. SDI-105 - Recommended Erection for Steel Doors and Frames.
- B. Fire Rated Door Construction: Conform to one of the following:
 - 1. NFPA 252; with neutral pressure level at 40 inches maximum above sill at 5 minutes into test.
 - 2. UL 10C - Standard for Positive Pressure Fire Test for Door Assembly.
 - 3. 20-Minute Fire Rated Corridor Doors: Fire tested without hose stream test.
 - 4. NFPA 80 - Fire Doors and Windows.
- C. Fire Rated Door Construction: Conform to UBC Standard 7-2.
- D. Fire Rated Stair Doors: Rate of rise of 450 degrees F across door thickness.
- E. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.
- F. Attach label from agency approved by authority having jurisdiction to identify each fire rated door.
 - 1. Indicate temperature rise rating for stair doors.

- G. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255, UL 723.
- H. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation material.

PART 2 PRODUCTS

2.1 STEEL DOORS AND FRAMES

- A. Manufacturers:
 - 1. Ceco Door Products.
 - 2. Republic Doors.
 - 3. Steelcraft.
 - 4. Curries Manufacturing, Inc.
- B. Product Description: Standard shop fabricated steel doors and frames; fire rated and non-rated types; flush face or stile and rail design.

2.2 COMPONENTS

- A. All doors and frames shall be manufactured of commercial quality cold rolled steel per ASTM A366 and A568 general requirements; galvanized to A60 or G60 or galvanized to A40 minimum coating weight standard per ASTM A924. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM A569.
- B. Supports and anchors shall be fabricated of not less than 18-gauge sheet steel, galvanized where galvanized frames are used.
- C. Where items are to be built into exterior walls, inserts bolts and fasteners shall be hot dipped galvanized in compliance with ASTM A153, Class C or D as applicable.
- D. Rust inhibitive enamel or paint primer shall be used, baked on and suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces on Steel Doors and Frame."
- E. Provide all hollow metal doors and frames receiving electrified hardware with Molex wiring harness and concealed plug connectors on one end to accommodate up to twelve wires. Coordinate Molex connectors on end of the wiring harness to plug directly into the electrified hardware and the electric hinge.

2.3 DOORS

- 1. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - a. Design: Flush panel.
 - b. Core Construction: Face sheets are supported by a steel stiffened core with polyurethane filler. 22-gauge stiffeners are placed no more than 6" apart and welded no more than 5" along their length. The core fills the entire door cavity and is chemically bonded to all interior surfaces.

Density of foam exceeds 1.8 pcf and has a crush strength of 3600 psf. No stiffener face welding is permitted. Thermal properties for insulating foam core shall be a minimum R factor of 11.01, as calculated per ASTM C518.

- c. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.042 inch - 1.1 mm) thick steel, Model 2.
 - d. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam continuously welded, filled and ground smooth the full height of door.
 - 1) Vertical Edges for Single-Acting Doors: Beveled Edge, 1/8 inch in 2 inches.
 - e. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16-gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - f. Hinge Reinforcement: Minimum 7-gauge (3/16") plate 1 1/4" x 9."
 - g. Acceptable Manufacturers:
 - 1) CECO Door Products - Trio-E Series.
 - 2) Curries Company - Trio-E Series.
- B. All doors shall be reinforced for hardware as shown below where necessary to preclude the use of thru-bolts.
- 1. Exit Devices: 14-gauge.
 - 2. Door Closers: 12-gauge.
- C. All doors shall be beveled 1/8" in 2" and shall have top and bottom channels of not less than 16-gauge, flush or inverted, welded to the face sheets. Doors shall have a full height 14-gauge hinge rail reinforcement channel or individual 10-gauge hinge reinforcements.
- D. All doors to conform to ANSI A250.4 Level "A" criteria and shall be tested to 1,000,000 operating cycles and 23 twist tests. Certification of Level "A" doors is to be submitted with approval drawings by supplier upon request. Do not bid or supply any type or gauge of door not having been tested and passed these criteria.

2.4 FRAMES

- A. Provide hollow metal frames for doors, transoms, sidelights, borrowed lights and other openings, of types and styles as shown on the drawings and schedules. Conceal fastenings unless otherwise indicated.
- 1. Exterior Frames: Level 2, 16-gauge, galvanized or galvanealed.
 - a. Ceco: SU Series.
 - b. Curries: M Series.
- B. Fabricate frames with mitered and faces only welded corners, re-prime at the welded areas. All welds to be flush with neatly mitered or butted material cuts.
- C. All frames shall have minimum 7-gauge hinge reinforcements, 14 gauge lock strike reinforcing and 12 gauge closer reinforcing.
- D. Provide temporary shipping bars to be removed before setting frames.

- E. Except on weather stripped or thermally broken frames, drill stops to receive three (3) silencers on strike jambs of single frames and two (2) silencers on heads of double frames.
- F. Provide minimum 0.0179" thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.5 ACCESSORIES

- A. Bituminous Coating: Fibered asphalt emulsion.
- B. Primer: ANSI A250.10 rust inhibitive type.
- C. Weatherstripping: Specified in Section 08710.

2.6 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project Site. Comply with ANSI/SDI 100 requirements.
 - 1. Clearances shall be no more than 1/8" at jambs and heads except between non-fire rated pairs of doors which may be no more than 1/4." Not more than 3/4" at the bottom of the doors.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel sheet.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold- or hot-rolled steel sheet.
- E. Unless otherwise indicated, provide exposed fasteners with countersunk flat or oval heads for exposed screws and bolts.
- F. At exterior locations and elsewhere as shown or scheduled, assemblies fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C236 or ASTM C976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with a minimum U-value rating of 0.41 Btu/sq. ft. x h x deg. F.
- G. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI-107 and ANSI A115 Series specifications for door and frame preparation for hardware.
- H. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project Site. Provide internal reinforcements for all doors to receive door closers and exit devices.

- I. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- J. Provide glazing stops with minimum 0.0359-inch-thick steel or 0.040 inch thick aluminum.
- K. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers and other panels in doors.
- L. Provide screw-applied, removable, glazing beads on inside of glass and other panels in doors.
- M. Attach fire rating label to each door and frame that is fire rated. Indicate temperature rise rating for stair doors.

2.7 SHOP FINISHING

- A. Steel Sheet: Galvanized to ASTM A653/A653M G90.
- B. Primer: Baked.
- C. Coat inside of frame profile with bituminous coating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.

3.2 INSTALLATION

- A. Install steel doors, frames and accessories according to shop drawings, manufacturer's data and as specified.
- B. Comply with provisions of SDI-105, "Recommended Erection Instructions for Steel Door Frames," unless otherwise indicated. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing concrete, masonry or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 - 2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
 - 4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
 - 5. Install fire-rated frames according to NFPA 80.

- C. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100. Install fire rated doors with clearances specified in NFPA 80.

3.3 ADJUSTING AND CLEANING

- A. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Immediately before final inspection, remove protective wrappings from doors and frames.
- C. Tolerances:
 - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION

SECTION 08330

ROLLING GRILLES – OPEN DESIGN

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes electric operated overhead rolling grilles.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Cycle Life:
 - a. Design grilles of standard construction for normal use of up to 5 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the grille.
 - 2. Safety:
 - a. Chain operated doors shall be designed so that the door immediately stops upward or downward travel and is maintained in a stationary position when the hand chain is released by user.
 - 3. Headroom:
 - a. Fully coiled curtain with bracket not to exceed 11.75" in diameter.

1.3 QUALITY ASSURANCE

- A. Submit the following items:
 - 1. Product Data
 - 2. Shop Drawings
 - 3. Quality Assurance/Control Submittals:
 - a. Provide proof of manufacturer ISO 9001:2015 registration
 - b. Provide proof of manufacturer and installer qualifications – see 14 below
 - c. Provide manufacturer's Health Product Declaration (HPD) for each product
 - 4. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Certificate stating that installed materials comply with this specification

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: ISO 901:2015 registered and a minimum of five year experience in producing grilles of the type specified.
 - 2. Installer Qualifications: Manufacturer's approval

1.5 DELIVERY STORAGE AND HANDLING

- A. Following manufacturer's instructions

1.6 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship, on mechanical components, operator and control panel.
- B. Maintenance: Submit for owner's consideration and acceptance of a req

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer:
Cornell
24 Elmwood Ave.
Mountain Top, PA 18707
[Tel:\(800\) 233-8366](tel:8002338366)

Model: ESG10C (Straight Pattern)

1. Cookson
2. Clopay Building Products

Substitutions: Not Permitted

2.2 MATERIALS

- A. Curtain:
1. ESG10C Straight Pattern
 - a. Horizontal Rods: Minimum solid (5/16-inch) diameter, 5056 H32 aluminum alloy links on alternate rods with continuous end tube spacers.
 - b. Vertical Spacing: 2.5-inches on center
 - c. Vertical Chains: 1/4-inch wide, positioned by aluminum on 9-inch centers. Provide nylon insert nuts threaded on to the end of each rod to secure the chains.
 2. Finish:
 - a. Stainless Steel: Type 304 #4 finish
- B. Bottom Bar:
1. Fabrication
 2. Finish
- C. Guides: Wall Mounted: Heavy duty (minimum .109-inch thick) extruded aluminum sections with snap-on cover to conceal fasteners and Santoprene runners on both sides of curtain. Provide steel mounting angle as required for face of wall installation.
1. Fabrication:
 - a. Aluminum Guide:
 1. Finish: Mill finish
 - b. Steel Mounting Mounting Angles Finish:
 1. Standard (Stock Colors): Phosphate treatment followed by a baked-on polyester powder coat: minimum 2.5 mills cured film thickness
- D. Counterbalance Shaft Assembly:
1. Barrel: Minimum 6-inch steel pipe with a 1-1/2-inch inner shaft capable of supporting curtain load with maximum deflection of 0.5125 inches per foot of width.
 2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25 lbs. (110 N). Provide wheel for applying and adjusting spring torque.

- E. Brackets: Fabricate from minimum 1/4-inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - 1. Finish:
 - a. Hot-dip Galvanized: ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.

2.3 OPERATION

- A. Supply Model SG Electric Motor Operator, continuous duty, UL listed, Totally Enclosed Fan Cooled gear head operator(s) rated (1/2) to (7-1/2) hp as recommended by door manufacturer for size and type of door, 208 Volts, 1 Phase. Provide complete with electric motor and factor pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s). Motor shall be high starting torque, industrial type, with overload protection. Primary speed reduction shall be heavy-duty gears running in grease or oil bath with protection. Primary speed reduction shall be heavy-duty gears running in grease or oil bath with mechanical braking to hold the door in any position. The emergency manual chain hoist assembly is automatically disengaged when motor is energized. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with minimum #50 roller chain. Operator shall be capable of driving the door at a speed of 6- to 9-inches per second. Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The motor shall be removable without affecting the limit switch settings. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
- B. Entrapment Protection: Provide the following primary entrapment protection device to enable momentary contact close operation.
 - 1. SafetyGard UL325 Light Curtain with Dynamic Sequential Blanking: Provide monitored, non-contact light curtain consisting of a transmitter and a receiver to be mounted to the guide assembly of the door in the provided mounting channel, projecting a thru beam across the width of the door for the height of the light curtain (3 ft or 6 ft, depending on opening size of the door). Interruption of beam before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position.
 - 2. Provide an electric sensing edge device. Contact before grille fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

2.4 ACCESSORIES

- A. Locking:
 - 1. Keyed cylinder locking into both jambs operable from both sides of curtain with motor interlock cutout switches.
- B. Vibration Isolators:
 - 1. Include continuous vibration isolators pre-installed on both guides to reduce vibration transferred from the door to the structure. Vibration isolators should be expected to reduce vibration by up to 14%. Dampening pads are to be manufactured from nitrile oil-resistant rubber, durometer 50A.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

- A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers, and supports.
- B. Follow the manufacturer's installation instructions.

3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of protection, free from warp, twist, or distortion.

3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer
- B. Remove surplus material and debris from the site

3.5 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08332

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Service doors.
 - 2. Counter doors.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions.
 - 1. Wind Loads: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - a. Basic Wind Speed: 85 mph
 - b. Exposure Category
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.3 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. For fire-rated doors, description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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. Wiring 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 required, prepared on Samples of size indicated below.
 - 1. Curtain Slats: 12 inches long.
 - 2. Bottom Bar: 6 inches long
 - 3. Guides: 6 inches long.
 - 4. Brackets: 6 inches square.
 - 5. Hood: 6 inches square.
- E. Delegated-Design Submittal: For overhead coiling doors 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. Detail fabrication and assembly of seismic restraints.
 - 2. Summary of forces and loads on walls and jambs.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling door manufacturer.
- C. 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.
- D. Regulatory Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines] [and] [ICC/ANSI A117.1].

PART 2 – PRODUCTS

2.1 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 and as required to meet requirements.
 - 2. Aluminum Door Curtain Slats: ASTM B 209 sheet or ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch and as required to meet requirements.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- D. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.
- F. 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.
- G. 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.

2.2 HOOD

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. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
2. Aluminum: 0.040-inch- thick aluminum sheet complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

2.3 COUNTER DOORS

A. Integral Frame, Hood, and Fascia for Counter Door: Welded sheet metal assembly of the following sheet metal:

1. Galvanized Steel: Nominal 0.064-inch thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
2. 2. Stainless Steel: 0.062-inch thick stainless-steel sheet, Type 304, complying with ASTM A 666.

B. Integral Metal Sill for Counter Door: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.

C. Fire-Rated, Laminate Counter: Fire-door manufacturer's high-pressure decorative laminate-covered countertop, UL or ITS tested and labeled for 1-1/2-hour fire rating for approved use with fire-door assembly.

2.4 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

C. Chain Lock Keeper: Suitable for padlock.

D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.5 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 inches high.

2.6 COUNTERBALANCING 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. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf .
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

- D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.8 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 - 2. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 - 3. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 - 4. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 11 05 13 "Common Motor Requirements for Equipment" unless otherwise indicated.
 - 1. Electrical Characteristics:
 - a. Phase: Single phase.
 - b. Volts: 115.
 - c. Hertz: 60.
 - 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.
 2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 2. Exterior units, full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.
- L. Radio-Control System: Consisting of the following:
 - 1. Three-channel universal coaxial receiver to open, close, and stop door; three per operator.
 - 2. Multifunction remote control.
 - 3. Remote-antenna mounting kit.

2.9 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of- Design Product: Subject to compliance with requirements, provide Series 620 rolling door by Overhead Door Corporation, or comparable product by one of the following:
 - a. ACME Rolling Doors, model FWMO.
 - b. Cornell Iron Works, Inc., Model ESD10.
- B. Operation Cycles: Not less than 50,000.
 - 1. Include tamperproof cycle counter.
- C. Door Curtain Material: Galvanized steel .
- D. Door Curtain Slats: Flat profile slats of 1-1/4-inch center-to-center height.
- E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- F. Hood: Match curtain material and finish
 - 1. Shape: Round
- G. Locking Devices: Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly: Single-jamb side
- H. Manual Door Operator: Push-up operation
 - 1. Provide operator with manufacturer's standard removable operating arm.
- I. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 60 to 90 cycles per hour
 - 2. Operator Location:
 - 3. Motor Exposure: Interior
 - 4. Emergency Manual Operation: Chain type.
 - 5. Obstruction-Detection Device: Automatic photoelectric sensor.
 - a. Sensor Edge Bulb Color: Black
 - 6. Remote-Control Station: Interior.
 - 7. Other Equipment: Radio-control system.

- J. Door Finish:
 - 1. Stainless-Steel Finish: No. 4 (polished directional satin).
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.10 DOOR ASSEMBLY

- A. Counter Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Series 652 Counter shutter by Overhead Door Corporation, or comparable product by one of the following:
 - a. ACME Rolling Doors, Counter Shutter.
 - b. Cornell Iron Works, Inc., Model ESC10
- B. Operation Cycles: Not less than 50,000.
 - 1. Include tamper-proof cycle-counter
- C. STC Rating: 26.
- D. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu.
- E. Door Curtain Material: Stainless-Steel
- F. Door Curtain Slats: Flat profile slats of 1-1/4-inch.
- G. Curtain Jamb Guides: Stainless Steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise and jamb guides where shown on Drawings.
- H. Hood: Stainless Steel
 - 1. Shape: Square
 - 2. Mounting: Face of wall.
- I. Integral Frame, Hood, and Fascia for Counter Door: Stainless Steel
 - 1. Mounting: Face of wall
- J. Sill Configuration for Counter Door: No sill. Integral metal sill.
- K. Locking Devices: Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly: Single-jamb side locking bars, operable from inside with thumb turn.
- L. Manual Door Operator: Push-up operation.
 - 1. Provide operator with manufacturer's standard removable operating arm.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. 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.

2.13 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 START-UP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weather tight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

SECTION 08360
OVERHEAD DOORS

PART 1 – GENERAL

1.1 SECTION INCLUDES:

- A. Insulated Sectional Overhead Doors.
- B. Electric Operators and Controls
- C. Operating Hardware, tracks, and support.

1.2 REFERENCES

- A. ANSI/DASMA 102 – American National Standard Specification for Sectional Overhead Type Doors.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wiring Connections: Requirements for electrical characteristics.
 - 1. 115 volts, single phase, 60 Hz.
- B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details. Manufacturer's Certificates: Certify products meet or exceed specified requirements. Operation and Maintenance Data.
- C. QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of five years' documented experience.
 - B. Installer Qualifications: Authorized representative of the manufacturer with a minimum of five years' documented experience.
 - C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated weathertight location.

1.6 PROJECT CONDITIONS

- A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.7 WARRANTY

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

- A. Acceptable Manufacturer: Overhead Door Corporation, 2501 S. State Hwy 121, Suite 200, Lewisville, TX 75067.
ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499
Web Site: www.overheaddoor.com
E-Mail: info@overheaddoor.com

- B. Substitutions: Permitted

2.2 INSULATED SECTIONAL OVERHEAD DOORS

- A. Insulated Steel Sectional Overhead Doors: Model 418 Insulated Steel Doors by Overhead Door Corporation. Units shall have the following characteristics:
 - 1. Door Assembly: Insulated steel door assembly with rabbeted meeting rails to provide full-width interlocking structural rigidity.
 - a. Panel Thickness: 2 inches.
 - b. Exterior Surface: Flush.
 - c. Exterior Steel: 16 gauge, hot-dip galvanized.
 - d. Back Cover:
 - 1) 26 gauge steel.
 - 2) Poly-Backed.
 - 3) High Impact Polystyrene Back cover.
 - e. Center and End Stiles: 16 gauge steel.
 - f. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.
 - 1) Standard cycle spring: 10,000 cycles.
 - g. Insulation: Polystyrene.
 - h. Thermal Values:
 - 1) Polystyrene – Calculated section R-value of 7.35.
 - i. Partial Glazing of Steel Panels:
 - 1) Insulated double strength glass, 24 inch by 7 inch window.
 - 2) Insulated tempered glass, 24 inch by 7 inch window.

2. Finish and Color: Two coat baked-on polyester with almond exterior and white interior color.
3. Wind Load Design: Design as calculated in accordance with applicable code as follows:
 - a. Provide to meet Florida Building Code Product Approval #FL 11734 Non-Impact.
4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.
5. Lock:
 - a. Keyed lock with interlock switch for automatic operator.
6. Weatherstripping:
 - a. Flexible bulb-type stirp at bottom section.
 - b. Flexible Jamb seals.
 - c. Flexible Header seal.
7. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
 - a. Size:
 1. 3-inch.
 - b. Type:
 - Standard lift.
8. Manual Operation: Chain hoist
9. Electric Motor Operation: Provide UL listed electric operator, size, and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.
 - a. Entrapment Protection: Required for momentary contract, includes radio control operation.
 1. Pneumatic sensing edge up to 18 feet wide. Constant contact only complying with UL 325/2010.
 2. Electric sensing edge monitored to meet UL 325/2010.
 - b. Operator Controls:
 1. Push-button and key-operated controls with open, close, and stop buttons.
 2. Flush mounting.
 3. Surface mounting.
 4. Interior location.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until openings have been properly prepared.
- B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- C. Verify electric power is available and of correct characteristics.
- D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean adjacent surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.
- D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware.
- F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.4 CLEANING AND ADJUSTING

- A. Adjust door assembly to smooth operation and in full contact with weatherstripping.
- B. Clean doors, frames, glass, and polycarbonate according to manufacturer's instructions.
- C. Remove temporary labels and visible markings. Do not remove polycarbonate care and maintenance label required to maintain warranty.

3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08422

SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of automatic entrances:
 - 1. Exterior and interior, 6-panel telescoping sliding automatic entrances.

1.2 REFERENCES

- A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
- B. Underwriter Laboratories (UL):
 - 1. UL 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- C. American National Standards Institute (ANSI) / Builders' Hardware Manufacture's Association (BHMA):
 - 1. ANSI/BHMA A156.10: Standard for Power Operated Pedestrian Doors
 - 2. ANSI/BHMA A156.5: Standard for Auxiliary Locks and Associated Products
 - 3. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- D. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials
- E. American Society for Testing and Materials (ASTM):
 - 1. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- F. American Association of Automatic Door Manufacturers (AAADM)
- G. National Fire Protection Association (NFPA):
 - 1. NFPA 101 – Life Safety Code
 - 2. NFPA 70 – National Electric Code
- H. International Code Council (ICC):
 - 1. IBC: International Building Code
- I. Building Officials and Code Administrators International (BOCA), 1999:

- J. International Organization for Standardization (ISO):
 - 1. ISO 9001 – Quality Management Systems
- K. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. Metal Finishes Manual for Architectural and Metal Products
- L. American Architectural Manufacturers Association (AAMA):
 - 1. AAMA 606.1 – Integral color Anodic Finishes for Architectural Aluminum
 - 2. AAMA 607.1 – Clear Anodic Finishes for Architectural Aluminum
 - 3. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum
 - 4. AAMA 701 – Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weather seals.

1.3 DEFINITIONS

- A. Activation Device: Device that, when actuated, sends an electrical signal to the door operator to open the door.
- B. Safety Device: Device that prevents a door from opening or closing, as appropriate.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide automatic entrance door assemblies capable of withstanding loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Operating RANGE: Minus 30°F to 130°F
- C. Opening-Force Requirements for Egress Doors: Force shall be adjustable; but, not more than 50 lbf required to manually set swinging egress door panel(s) in motion.
- D. Closing-Force Requirements: Not more than 30 lbf is required to prevent door from closing.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with the Conditions of the Contract and Division 1 Specification Sections.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware mounting heights, and attachments to other work.
- C. Color Samples for section of factory-applied color finishes.
- D. Closeout Submittals:
 - 1. Owner's Manual
 - 2. Warranties

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative, with certificate issued by AAADM, who is trained for installation and maintenance of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturing facility compliant with ISO 9001.
- C. Manufacturer shall have in place a national service dispatch center providing 24 hours a day, 7 days a week, emergency call back service.
- D. Certifications: Automatic sliding door systems shall be certified by the manufacturer to meet performance design criteria in accordance with the following standards:
 - 1. ANSI/BHMA A156.10
 - 2. NFPA 101
 - 3. UL 325 listed
 - 4. IBC
 - 5. BOCA
- E. Source Limitations: Obtain automatic entrance door assemblies through one source from a single manufacturer.
- F. Product Options: Drawings indicate sizes, profiles, and dimensional requirements of automatic entrance door assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- G. 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.
- H. Emergency-Exist Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

1.7 PROJECT CONDITIONS

- A. Field Measurements: General Contractor shall verify openings to receive automatic entrance door assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Mounting Surfaces: General Contractor shall verify all surfaces to be plumb, straight, and secure; substrates to be of proper dimension and material.
- C. Other Trades: General Contractor shall advise of any inadequate conditions or equipment.

1.8 COORDINATION

- A. Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic entrances to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrance door assemblies with connections to power supplies.

1.9 WARRANTY

- A. Automatic Entrances shall be free of defects in material and workmanship for a period of one(1) year from the date of substantial completion.
- B. During the warranty period, the Owner shall engage a factory-trained technician to perform service and affect repairs. A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Owner.
- C. During the warranty period, all warranty work, including but not limited to, emergency service, shall be performed during normal working hours.

PART 2 – PRODUCTS

2.1 AUTOMATIC ENTRANCES

- A. Manufacturer: Stanley Access Technologies; Dura-Fit™ Series sliding automatic entrances.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Headers, stiles, rails, and frames: 6063-T6.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221
 - 3. Sheet and Plate: ASTM B209.
- B. Sealants and Joint Fillers: Performed under Division 7 Section “Joint Sealants.”

2.3 AUTOMATIC ENTRANCE DOOR ASSEMBLIES

- A. General: Provide manufacturer's standard automatic entrance door assemblies, including doors, sidelights, framing, headers, carrier assemblies, roller tracks, door operators, activation, and safety devices, and accessories required for a complete installation.

- B. Sliding Automatic Entrances:
1. Configuration: Four sliding panels and two full sidelights; bi-parting, telescoping
 2. Traffic Pattern: Two-way
 3. Emergency Breakaway Capability: sliding panels and sidelights, such that each 3-panel half breaks out as a single swinging panel.
 4. Mounting: Between jambs.

2.4 COMPONENTS

- A. Framing Members: Manufacturer's standard extruded aluminum reinforced as required to support imposed loads.
1. Nominal Size: 1-3/4 inch by 6-inch.
 2. Concealed Fastening: Framing shall incorporate a concealed fastening pocket and continuous flush insert cover, extending full length of each framing member.
- B. Stile and Rail Sliding Panels and Sidelights: Manufacturer's standard 1-1/2-inch-thick glazed doors with extruded-aluminum tubular stile and rail members. Incorporate concealed mechanical fasteners at corners, minimum two fasteners per corner.
1. Glazing Stops and Gaskets: Stops shall be integrally extruded into stiles and rails.
 2. Stile Design: Narrow stile: 1-inch nominal width; with 2-3/8-inch lock stiles. Stiles shall have interlocking design to secure panels, over full panel height, with doors in closed position.
 3. Bottom Rail Design: Minimum 10 inch nominal height.
 4. Muntin Bars: None
- C. Glazing: Provide glazing for sliding automatic entrances as follows:
1. Provide safety glass complying with ANSI Z97.1 and CPSC 16 CFR 1201 for Category II materials.
 2. Safety Glass: 1-1/4-inch hermetically sealed insulated glazing units.
- D. Headers: Fabricated from extruded aluminum and extending full width of automatic entrance door units to conceal door operators, carrier assemblies, and roller tracks. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: Concealed, flush with framing.
 2. Capacity: Capable of supporting up to 72 lb. per panel, up to six panels, over spans up to 9 feet without intermediate support.
- E. Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment of at least 3/16-inch, consisting of high-density polymer load wheels with precision steel lubricated ball-bearings, operating on an extruded aluminum roller track. Minimum two load wheels and two anti-rise load wheels for each active leaf. Minimum load wheel diameter shall be 1-1/4-inch.
- F. Thresholds: Manufacturer's standard thresholds as indicated below:
1. Continuous standard tapered extrusion double bevel.
 2. All thresholds to conform to details and requirements for code compliance.

G. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

H. Signage: Provide signage in accordance with ANSI-BHMA A156.10.

2.5 DOOR OPERATORS

A. General: Provide door operators of size recommended by manufacturer for door size, weight, and movement for condition of exposures; and for long-term, operation under normal traffic load for type of occupancy indicated.

B. Electromechanical Operators: Self-contained overhead unit powered by a minimum of 1/4 horsepower, permanent-magnet DC motor with gear reduction drive, microprocessor controller; and encoder.

1. Operation: Power opening and power closing.

2. Features:

- a. Adjustable opening and closing speeds
- b. Adjustable open check and close check speeds
- c. Adjustable hold-open time between 0 and 30 seconds
- d. Obstruction recycle
- e. On/Off switch to control electric power to operator
- f. Energy conservation switch that reduces door-opening width
- g. Closed loop speed control with active braking and acceleration
- h. Adjustable obstruction recycle time delay
- i. Self-adjusting stop position
- j. Self-adjusting closing compression force
- k. Onboard sensor power supply
- l. Onboard sensor monitoring
- m. Optional Switch to open/switch to close operation
- n. Fire alarm interface, configurable to safety open to close the entrance on signal from fire alarm system

3. Mounting: Concealed

4. Drive System: Synchronous belt type

C. Electrical service to door operators shall be provided under Division 26 Electrical. Minimum service to be 120 VAC, 5 amps.

2.6 ELECTRICAL CONTROLS

A. Electrical Control System: Electrical control system shall include a microprocessor controller and a high-resolution position encoder. The encoder shall monitor revolutions of the operator shaft and send signals to microprocessor controller to define door position and speed.

1. The high-resolution encoder shall have a resolution of not less than 1024 counts per revolution. Systems utilizing external magnets and magnetic switches are not acceptable.

2. Electrical control system shall include a 24 VDC auxiliary output rated at 1 amp.

- B. Performance Data: The microprocessor shall collect, and store performance data as follows;
 - 1. Counter: A non-resettable counter to track operating cycles.
 - 2. Event Reporting: Unit shall include non-volatile event and error recording including number of occurrences of events and errors, and cycle count of most recent events and errors.
 - 3. LED Display: Display presenting the current operating state of the controller.
- C. Controller Protection: The microprocessor controller shall incorporate the following features to ensure trouble free operation:
 - 1. Automatic Reset Upon Power Up
 - 2. Main Fuse Protection
 - 3. Electronic Surge Protection
 - 4. Resettable sensor supply fuse protection
 - 5. Motor Protection, over-current protection
- D. Soft Start/Stop: A "soft-start" soft-stop" motor driving circuit shall be provided for smooth normal opening and recycling.
- E. Obstruction Recycle: Provide system to recycle the sliding panels when an obstruction is encountered during the closing cycle. If an obstruction is detected, the system shall search for that object on the next closing cycle by reducing door closing speed prior to the previously encountered obstruction location and will continue to close in check speed until doors are fully closed, at which time the doors will reset to normal speed. If obstruction is encountered again, the door will come to a full stop. The doors shall remain stopped until obstruction is removed and operate signal is given, resetting the door to normal operation.
- F. Programmable Controller: Microprocessor shall be field programmable.
 - 1. The following parameters may be adjusted:
 - a. Operating speeds and forces as required to meet the specified ANSI/BHMA standard.
 - b. Adjustable and variable features specified
 - c. Reduced opening position
 - 2. Manual programming shall be available through local interface which has a two-digit display with a selection control, including three push button.

2.7 ACTIVATION AND SAFETY DEVICES

- A. Combined Activation and Safety Sensors: Combined activation and safety sensors shall, in a single housing, detect motion and presence in accordance with ANSI/BHMA A156.10. Motion shall be detected using K-band microwave technology, presence by active infrared reflection technology.
 - 1. Mounting Height: Up to 11.5 feet above finish floor.
 - 2. Temperature Range: Between -31°F and 131°F in all environmental conditions.
 - 3. Relays: Form C, 50FV at 0.3A for both activation and safety. Hold time of less than 0.5 seconds.

4. Detection Pattern: When detection is made in the activation zone, and the entrance opens, the safety zone shall extend through the threshold on each side, creating an X-pattern. When activation and safety zones are cleared and the entrance closes, the sensor will ignore the X-pattern safety zones.
 5. Combined motion and presence sensors shall be equal to or better than X-Zone Sensor by Optex.
- B. Presence Sensor Monitoring: Sliding automatic entrances control system shall include a means to verify the functionality of all active presence sensors in accordance with ANSI/BHMA A156.10 A detected fault shall cause automatic operation to cease until the fault is corrected.

2.8 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance door and hardware manufacturers for entrances and uses indicated.
- B. Emergency Breakaway Feature: Provide release hardware that allow panel(s) to swing out in direction to egress to full 90 degrees from any position in sliding mode. Maximum force to open pane shall be 5 lbf (222 N) according to ANSI/BHMA A156.10. Interrupt powered operation of panel operator while in breakaway mode.
1. Emergency breakaway feature shall include at least one adjustable detent device mounted in the top of each breakaway panel to control panel breakaway force.
 2. Limit Arms: Limit arms shall be provided to control swing of panels on break-out; swing shall not exceed 90 degrees. Limit arms shall be spring loaded to prevent shock, and include adjustable friction damping.
- C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn; with minimum 1-inch-long throw bolt; ANSI/BHMA A156.5, Grade 1.
1. Cylinders: Provide lock cylinders by BEST Access Systems, with core and key.
 2. Hook Latch: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
 3. Two-Point Locking: Provide locking system that incorporates a device in the stile of active door leaves that automatically extends a flush bolt into overhead carrier assembly.
 4. Armored Strike: Provide reinforced security strike plate.
- D. Control Switch: Provide manufacturer's standard header mounted rocker switches and door position switch to allow for full control of the automatic entrance door. Controls to include but not limited to:
1. One-way traffic
 2. Open/Closed/Automatic
- E. Power Switch: Sliding automatic entrances shall be equipped with a two position On/Off rocker switch to control power to the door.
- F. Sliding Weather Stripping: Manufacturer's standard replaceable components complying with AAMA 701; made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

- G. Weather Sweeps: Manufacturer's standard adjustable nylon brush sweep mounted to underside of door bottom.

2.9 FABRICATION

- A. General: Factory fabricates automatic entrance door assembly components to designs, sizes, and thickness indicated and to comply with indicated standards.
 - 1. Form aluminum shapes before finishing
 - 2. Use concealed fasteners to greatest extent possible
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices
 - b. Reinforce members as required to receive fastener threads.
- B. Framing: Provide automatic entrances as prefabricated assemblies.
 - 1. Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Prepare components to receive concealed fasteners and anchor and connection devices.
 - 5. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairlines joints free of burrs and distortions.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Door Operators: Factory fabricated and installed in headers, including adjusting and testing
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.
- F. Hardwood: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.10 ALUMINUM FINISHES

- A. General: Comply with NAAMM Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designing finishes. Finish designations prefixed by AA comply with system established by Aluminum Association for designing finishes.

- B. Class 1, Color Anodic Finish: AA-M12C22A42/A44 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.70 mils minimum complying with AAMA 611-98, and the following:
 - 1. Color: Dark Bronze
 - 2. AAMA 606.1
 - 3. Applicator must be fully compliant with all applicable environmental regulations and permits, including wastewater and heavy metal discharge.

PART 3 – EXECUTION

3.1 INSPECITON

- A. Examine conditions for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to the greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
- C. Door Operators: Connect door operators to electrical power distribution system as specified in Division 26 Sections.
- D. Glazing: Glaze sliding automatic entrance door panels in accordance with, the Glass Association of North America (GANA) Glazing Manual, published recommendations of glass product manufacturer, and sliding automatic entrance manufacturer's instruction.
- E. Sealants: Comply with requirements specified in Division 7 Section "Joint Sealants".

3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.

3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for tight closure, and comply with requirements in ANSI-BHMA A156.10.

3.5 CLEANING AND PROTECTION

- A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Division 8 Section "Glazing", for cleaning and maintaining glass.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY:

- A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors.
 - 2. Door hardware for aluminum doors.
 - 3. Door hardware for wood doors.
 - 4. Door hardware for other doors indicated.
 - 5. Keyed cylinders as indicated.
- B. Intent of Hardware Groups
 - 1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.

1.2 SUBMITTALS:

- A. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.
- B. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
- C. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
 - 1. List groups and suffixes in proper sequence.
 - 2. Completely describe door and list architectural door number.
 - 3. Manufacturer, product name, and catalog number.
 - 4. Function, type, and style.
 - 5. Size and finish of each item.
 - 6. Mounting heights.
 - 7. Explanation of abbreviations and symbols used within schedule.
 - 8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1.
 - 1. Deliver products in original unopened packaging with legible manufacturer's identification.

1.4 PROJECT CONDITIONS:

- A. Coordinate hardware with other work. Furnish hardware items of proper design for use on and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

1.5 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
 - 1. Closers: Ten years
 - 2. Exit Devices: Five Years
 - 3. Locksets & Cylinders: Three years
 - 4. All other Hardware: Two years.

1.6 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
 - 1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
 - 2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
 - 3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.

1.7 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.

1.8 MATERIALS:

- A. Hinges: Shall be Five Knuckle Ball bearing hinges
 - 1. Template screw hole locations.
 - 2. Non-Removable Pin screws shall be slotted stainless steel screws.
 - 3. Hinges shall be full polished, front, back and barrel.
 - 4. Provide hinge type as listed in schedule.
 - 5. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.

- B. Geared Continuous Hinges:
 - 1. Anti-spinning through fastener
 - 2. UL10C listed for 3-hour Fire rating
 - 3. Non-handed
 - 4. Lifetime warranty

- C. Exit Devices:
 - 1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
 - 2. Exit devices chassis to be investment cast steel, zinc dichromate.
 - 3. Exit devices to have stainless steel deadlocking $\frac{3}{4}$ " through latch bolt.
 - 4. Exit devices to be equipped with sound dampening on touchbar.
 - 5. Non-fire rated exit devices to have cylinder dogging.
 - 6. Non-fire rated exit devices to have $\frac{1}{4}$ " minimum turn hex key dogging.
 - 7. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
 - 8. Touchbar assembly on wide style exit devices to have a $\frac{1}{4}$ " clearance to allow for vision frames.
 - 9. All exposed exit device components to be of architectural metals and "true" architectural finishes.
 - 10. Provide strikes as required by application.
 - 11. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
 - 12. The strike is to be black powder coated finish.
 - 13. Exit devices to have field reversible handing.
 - 14. Provide heavy duty vandal resistant lever trim. Lever design to match locksets and latchsets.
 - 15. Vertical Latch Assemblies to have gravity operation, no springs.

- D. Mortise Locksets
 - 1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra-Heavy Duty, Security Grade 2 and be UL10C.
 - 2. Provide 9001-Quality Management and 14001-Environmental Management. Fit ANSI A115.1 door preparation
 - 3. Functions and design as indicated in the hardware groups.
 - 4. Solid, one-piece, $\frac{3}{4}$ -inch (19mm) throw, anti-friction latchbolt made of self-lubricating stainless steel.

5. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended.
 6. Auxiliary deadlatch to be made of one-piece stainless steel, permanently lubricated. Provide sufficient curved strike lip to protect door trim.
 7. Lever handles must be of forged or cast brass, bronze or stainless-steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable.
 8. Lock shall have self-aligning, thru-bolted trim
 9. Levers to operate a roller bearing spindle hub mechanism.
 10. Spindle to be designed to prevent forced entry from attacking of lever.
 11. Each lever to have independent spring mechanism controlling it
- E. Cylinders:
1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
 2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
 3. Coordinate and provide as required for related sections.
- F. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- G. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- H. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.
- I. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 2. Provide fastener suitable for wall construction.
 3. Coordinate reinforcement of walls where wall stop is specified.
Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered.
- J. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.
- K. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
 2. UL10C Positive Pressure rated seal set when required.

- L. Thresholds: Thresholds shall be aluminum beveled type with maximum height of ½" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

1.9 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Match existing.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Master keys, Master keys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:
 - 1. 1 each Grand Master keys
 - 2. 4 each Master keys
 - 3. 2 each Change keys each keyed core
 - 4. 15 each Construction master keys
 - 5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - 1. Do not proceed until unsatisfactory conditions have been corrected.

2.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.

1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

2.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

2.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 1. Check and adjust closers to ensure proper operation.
 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - a) Verify levers are free from binding.
 - b) Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
- B. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

2.5 SCHEDULE OF FINISH HARDWARE:

- A. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

PART 3 - PRODUCTS

3.1 MANUFACTURERS:

The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

3.2 HARDWARE SCHEDULE

**Set
#1**

1	Cylinder - IC	As Required	626	SC

Notes:

Balance of hardware by sliding door manufacturer.

**Set
#2**

1	Cylinder - IC	As Required	626	SC

Notes:

Balance of hardware by overhead door manufacturer.

**Set
#3**

1	Cont Hinge	662HD UL EPT	AL	BE
1	Power Transfer	EPT-12C	AL	PR
1	Exit Device - Elec	C TDS MLR FL 2103 CA-03 S458	630	PR
1	Rim Cylinder - IC	20-057	626	SC
1	Vandal Pull	1097 PHI 21 S C S4	630	TR
1	Closer	8916 SDS	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Gasketing	5050B	BR	NA
1	Sweep	C627A	AL	NA
1	Drip Guard	16A	AL	NA
1	Door Position Switch	MC-7	BLK	DO
1	Power Supply	RPSMLR2		PR
1	Wire Termination Cable	WH-38		PR
1	Wire Termination Cable	WH-192P		PR
1	Card Reader	By Access Control Provider		BO

Notes:

Card reader by access control supplier.

Operation Description:

Door position switch monitors door position.

Valid credentials to momentarily unlock electric panic.

Free egress at all times.

**Set
#4**

1	Cont Hinge	662HD UL EPT	AL	BE
1	Power Transfer	EPT-12C	AL	PR
1	Exit Device - Elec	C TDS MLR 2103 CA-03 S458	630	PR
1	Rim Cylinder - IC	20-057	626	SC
1	Vandal Pull	1097 PHI 21 S C S4	630	TR
1	Closer	8916 SDST	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Gasketing	5050B	BR	NA
1	Sweep	C627A	AL	NA
1	Drip Guard	16A	AL	NA
1	Door Position Switch	MC-7	BLK	DO
1	Power Supply	RPSMLR2		PR
1	Wire Termination Cable	WH-38		PR
1	Wire Termination Cable	WH-192P		PR
1	Card Reader	By Access Control Provider		BO

Notes:

Card reader by access control supplier.

Operation Description:

Door position switch monitors door position.

Valid credentials to momentarily unlock electric panic.

Free egress at all times.

**Set
#5**

1	Cont Hinge	662HD UL EPT	AL	BE
1	Power Transfer	EPT-12C	AL	PR
1	Lockset - Electric	45HW 7 DEU 15J C LC	626	BE

1	Core - Keyed	20-061	626	SC
1	Closer	8916 SDST	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Wire Termination Cable	WH-50		PR
1	Wire Termination Cable	WH-192P		PR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Sweep	C627A	AL	NA
1	Door Position Switch	By Access Control Provider		BO
1	Wire Diagrams	Riser & Termination Documents		PR
1	Power Supply	By Access Control Provider		BO
1	Card Reader	By Access Control Provider		BO

Notes:

Operation Description:

Door position switch monitors door position.

Request to exit switch monitored by access control system.

Valid credentials to momentarily unlock elec lockset.

Free egress at all times.

**Set
#6**

3	Hinges	FBB1168 4 1/2 x 4 1/2	26D	BE
1	Power Transfer	EPT-12C	AL	PR
1	Exit Device - Elec	C TDS MLR FL 2103 CA-03 S458	630	PR
1	Rim Cylinder - IC	20-057	626	SC
1	Vandal Pull	1097 PHI 21 S C S4	630	TR
1	Closer	8916 SPA	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Wall Stop	1270WV	630	TR
1	Door Position Switch	MC-7	BLK	DO
1	Power Supply	RPSMLR2		PR
1	Wire Termination Cable	WH-38		PR
1	Wire Termination Cable	WH-192P		PR
1	Card Reader	By Access Control Provider		BO

Notes:

Card reader by access control supplier.

Operation Description:

Door position switch monitors door position.

Valid credentials to momentarily unlock electric panic.

Free egress at all times.

**Set
#7**

1	Cont Hinge	662HD UL EPT	AL	BE
1	Exit Device - Elec	2103 CA-03 S458	630	PR
1	Rim Cylinder - IC	20-057	626	SC
1	Vandal Pull	1097 PHI 21 S C S4	630	TR
1	Closer	8916 SDST	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Gasketing	5050B	BR	NA
1	Sweep	C627A	AL	NA
1	Drip Guard	16A	AL	NA

**Set
#8**

2	Cont Hinge	662HD UL EPT	AL	BE
1	Top Flushbolt	3820	626	TR
1	Flushbolt	3917 12"	626	TR
1	Lockset - Storeroom	45H 7 D 15J VT	626	BE
1	Mort Cylinder - IC	20-061	626	SC
2	Closer	8916 SDST	689	DO
2	Kick Plate	KO050 10" X 1" LDW B4E	630	TR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Gasketing	5050B	BR	NA
2	Sweep	C627A	AL	NA
1	Astragal Seal - Set	115NA	AL	NA
1	Drip Guard	16A	AL	NA
1	Astragal	By Door Manufacturer		

**Set
#9**

3	Hinges	FBB179 4 1/2 x 4 1/2	26D	BE
1	Lockset - Storeroom	45H 7 D 15J	626	BE
1	Mort Cylinder - IC	20-061	626	SC

1	Closer	8916 SPA	689	DO
1	Kick Plate	KO050 10" X 1" LDW B4E	630	TR
1	Wall Stop	1270WV	630	TR
1	Sweep	C627A	AL	NA
Set #10				
2	Cont Hinge	662HD UL	AL	BE
1	Removable Mullion	KR822	AL	PR
1	Mullion Cap Spacer	MCS822	AL	PR
1	Rim Cylinder - IC	20-057 (Mullion)	626	SC
1	Exit Device - Elec	2103 CA-03 S458	630	PR
1	Rim Cylinder - IC	20-057	626	SC
1	Exit Device	2101 Exit Only S458	630	PR
1	Vandal Pull	1097 PHI 21 S C S4 (Active)	630	TR
1	Vandal Pull	1097 PHI 21 S N S4 (Inactive)	630	TR
2	Closer	8916 SDST FC	689	DO
2	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Gasketing	5050B	BR	NA
2	Sweep	C627A	AL	NA
1	Astragal Seal - Set	115NA	AL	NA
1	Drip Guard	16A	AL	NA
Set #11				
2	Cont Hinge	661HD UL	AL	BE
1	Exit Device	FL 2201 Exit Only LBR S301	630	PR
1	Exit Device	FL 2208 4908A LBR S301	630	PR
1	Rim Cylinder - IC	20-057	626	SC
2	Closer - Elec Hold Open	8916 EMF PT 24V FC	689	DO
2	Kick Plate	KO050 10" X 1" LDW B4E	630	TR
2	Wall Stop	1270WV	630	TR
1	Astragal Seal - Set	115NA	AL	NA
1	Gasketing	5050B	BR	NA

Notes:

Operation Description:

Smoke detection system to release elec hold-open closers.

**Set
#12**

3	Hinges	FBB179 4 1/2 x 4 1/2	26D	BE
1	Lockset - Storeroom	45H 7 D 15J	626	BE
1	Mort Cylinder - IC	20-061	626	SC
1	Closer	8916 AF89 FC	689	DO
1	Kick Plate	KO050 10" X 1" LDW B4E	630	TR
1	Wall Stop	1270WV	630	TR

**Set
#13**

3	Hinges	FBB179 4 1/2 x 4 1/2	26D	BE
1	Lockset - Classroom	45H 7 R 15J	626	BE
1	Mort Cylinder - IC	20-061	626	SC
1	Closer	8916 SDS FC	689	DO
1	Kick Plate	KO050 10" X 1" LDW B4E	630	TR

**Set
#14**

3	Hinges	FBB179 4 1/2 x 4 1/2	26D	BE
1	Lockset - Classroom	45H 7 R 14J	626	BE
1	Mort Cylinder - IC	20-061	626	SC
1	Closer	8916 SDST FC	689	DO
1	Kick Plate	KO050 10" X 1" LDW B4E	630	TR

**Set
#15**

1	Cont Hinge	662HD UL EPT	AL	BE
1	Power Transfer	EPT-12C	AL	PR
1	Lockset - Electric	45HW 7 DEU 15J C LC	626	BE
1	Core - Keyed	20-061	626	SC
1	Closer	8916 SDS	689	DO
1	Kick Plate	KO050 10" X 2" LDW B4E	630	TR
1	Wire Termination Cable	WH-50		PR
1	Wire Termination Cable	WH-192P		PR
1	Threshold	425HD	AL	NA
1	Weatherstrip	160SA	AL	NA
1	Sweep	C627A	AL	NA
1	Door Position Switch	By Access Control Provider		BO
1	Wire Diagrams	Riser & Termination Documents		PR

1	Power Supply	By Access Control Provider	BO
1	Card Reader	By Access Control Provider	BO

Notes:

Operation Description:

Door position switch monitors door position.

Request to exit switch monitored by access control system.

Valid credentials to momentarily unlock elec lockset.

Free egress at all times.

End Of Schedule

SECTION 08800

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass glazing for metal frames and doors.
 - 2. Glass glazing materials and installation requirements are included in this section.

1.2 SYSTEM DESCRIPTION

- A. System performance to achieve continuity of building enclosure air barrier and vapor retarder with glass and glazing materials of this section.
- B. Glass Thickness: Select minimum thickness in accordance with ASTM E1300 to resist specified design loads.
- C. Structural Design: Design in accordance with Michigan Building Code 2009 Edition for most critical combination of wind, snow, seismic, and dead loads.
- D. Wind-Borne Debris Loads: Design and size glass located less than 60 feet above grade to withstand the following loads:
 - 1. Glass within 30 feet of Grade: ASTM E1886 and ASTM E1996; large missile impact test.
- E. Exterior Glass Deflection: Maximum of 1/175 of glass edge length or 3/4 inch, whichever is less with full recovery of glazing materials.
- F. Interior Glass Deflection: Maximum differential deflection for two adjacent unsupported edges when 50 plf force is applied to one panel at any point up to 42 inches above finished floor less than thickness of glass.
- G. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
 - 1. U-Values: NFRC 100.
 - 2. Solar Heat Gain Coefficients: NFRC 200.
 - 3. Solar Optical Properties: NFRC 300.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate sizes, layout, thicknesses, and loading conditions for glass.
- B. Product Data:
 - 1. Glass: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
 - 2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.
- C. Design Data:
 - 1. Submit design calculations for glass thicknesses.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and GANA FGMA Sealant Manual for glazing installation methods.

1.5 WARRANTY

- A. Furnish ten year manufacturer warranty including coverage for sealed glass units from seal failure, interpane dusting, misting, and replacement of defective glass.

PART 2 PRODUCTS

2.1 FLOAT GLASS MATERIALS

- A. Annealed Glass: ASTM C1036, Type 1 transparent flat, Quality Q3, float glass.
 - 1. Furnish annealed glass except where heat strengthened or tempered glass is required to meet specified performance requirements.
- B. Tempered Glass: ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
 - 1. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.
 - 2. Furnish tempered glass conforming to CPSC 16 CFR 1201 Category II at locations where safety glass is required by applicable code.

2.2 FLOAT GLASS PRODUCTS

- A. Float Glass Manufacturers:
 - 1. Substitutions: Permitted.
- B. Clear Glass: Annealed and Tempered float glass as specified; Class 1 clear.
 - 1. Clear annealed glass (FG-CA).
 - 2. Clear tempered glass (FG-CT).
 - 3. Minimum Thickness: ¼ inch unless otherwise indicated.
- C. Low E Glass: Tempered float glass as specified; Class 1 clear.
 - 1. Clear Low E tempered glass (FG-ECT).

2.3 FIRE RESISTIVE GLASS PRODUCTS

- A. Fire Resistive Ceramic Glass: Transparent polished both surfaces.
 - 1. Clear fire resistive ceramic glass (FRG-CC).
 - 2. Patterned fire resistive ceramic glass (FRG-PC).
 - 3. Thickness: 3/4-inch.
 - 4. Fire Rating: 45- and 90-minute rating as listed in UL Building Materials Directory and approved by authority having jurisdiction for applications indicated.

2.4 INSULATING GLASS PRODUCTS

- A. Insulating Glass Manufacturers:
 - 1. Guardian Industries Corp.
 - 2. PPG Industries.
 - 3. Substitutions: Permitted.

- B. Insulating Glass: ASTM E2190 certified by Insulating Glass Certification Council and Insulating Glass Manufacturers Alliance; with glass elastomer edge seal; place reflective film within unit; purge interpane space with dry hermetic air.
 - 1. Insulating Glass Unit Edge Seal Construction: Stainless steel, thermally broken, bent and spot welded, mitered and spigoted corners.
 - 2. Insulating Glass Unit Edge Seal Material: White color.
- C. Double Pane Insulating Vision Glass IG-DP:
 - 1. Total Unit Thickness: 1 inch.
 - 2. Outer Pane: Glass Type FG-CT.
 - 3. Inner Pane: Glass Type FG-ECT.
 - 4. U-Factor Winter: 0.29 maximum.
 - 5. U-Factor Summer: 0.28 maximum.
 - 6. Solar Heat Gain Coefficient: 0.29 maximum.
 - 7. UV Transmittance: 8% maximum.

2.5 GLAZING SEALANTS

- A. Elastomeric Glazing Sealants: Materials compatible with adjacent materials including glass, laminated glass core, insulating glass seals and glazing channels.
 - 1. Silicone Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component; solvent curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.
 - a. Color: As selected.
 - b. Structural Silicone: Furnish high-modulus structural silicone glazing materials where sealant bonds glass to substrate.
 - c. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
 - 2. Polyurethane Glazing Sealant: ASTM C920, Type S, Grade NS, Class and Use suitable for glazing application indicated; single component, chemical curing, non-staining, non-bleeding, Shore A Hardness Range 20 to 35.
 - a. Color: As selected.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- B. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; color as selected.
 - 1. Neoprene: ASTM C864.
 - 2. EPDM: ASTM C864.
 - 3. Silicone: ASTM C1115.
- C. Soft Gaskets: ASTM C509 Type II; resilient extruded shape to suit glazing channel retaining slot; color as selected.
 - 1. Neoprene.
 - 2. EPDM.
 - 3. Silicone.
- D. Pre-Formed Glazing Tape: Size to suit application.
 - 1. Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
 - a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
 - b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect air barrier and vapor retarder seal.
 - a. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

2.6 GLAZING ACCESSORIES

- A. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness.
- C. Glazing Clips: Manufacturer's standard type.
- D. Fire-Resistant Glazing Materials: Materials used to obtain required fire-resistant rating.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings for glazing are correctly sized, within tolerance, and glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 PREPARATION

- A. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- B. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

- A. Perform installation in accordance with GANA Glazing Manual.
 1. Glazing Sealants: Comply with ASTM C1193.
 2. Fire Rated Openings: Comply with NFPA 80.
- B. Exterior Wet/Dry Method (Preformed Tape and Sealant) Installation:
 1. Cut glazing tape to length and set against permanent stops. Seal corners by butting tape and dabbing with compatible butyl sealant.
 2. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete continuity of air and vapor seal.
 3. Place setting blocks at ¼ points.
 4. Rest glazing on setting blocks and push against tape with sufficient pressure to attain full contact at perimeter of pane or glass unit.
 5. Install removable stops, with spacer strips inserted between glazing and applied stops, ¼ inch below sight line.
 6. Fill gap between glazing and stop with elastomeric glazing sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
 7. Apply cap bead of elastomeric glazing sealant along void between stop and glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

- C. Interior Wet Method (Compound and Compound) Installation:
 - 1. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept ¼ inch below sight line.
 - 2. Locate and secure glazing pane using glazers' clips.
 - 3. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.
- D. Plastic Film Installation:
 - 1. Install plastic film with adhesive.
 - 2. Place without air bubbles, creases or visible distortion.
 - 3. Fit tight to glass perimeter with razor cut edge.

3.4 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.5 SCHEDULE

- A. Exterior Windows: Type IG-DP, Clear, exterior wet/dry method with silicone glazing sealant exterior.
- B. Exterior Entrances: Type IG-DP, Clear, exterior wet/dry method with silicone glazing sealant exterior.
- C. Interior Non-Fire Rated Doors and Windows: Type SG-CT, interior wet method with paintable polyurethane glazing sealant.
- D. Interior Fire Rated Doors and Windows: Type FRG-CC, with fire rated glazing system.

END OF SECTION

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes gypsum board with joint treatment; metal stud wall framing; metal channel ceiling framing; and acoustic insulation.

1.2 SUBMITTALS

- A. Product Data: Submit data on metal framing, gypsum board, joint tape; acoustic accessories.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840. GA-201 - Gypsum Board for Walls and Ceilings. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board. GA-600 - Fire Resistance Design Manual.
- B. Furnish framing materials in accordance with SSMA - Product Technical Information.
- C. Fire Rated Wall Construction: Rating as indicated on Drawings in conjunction with Section 05400, 06100.
 - 1. Tested Rating: Determined in accordance with ASTM E119.
 - 2. Fire Rated Partitions: Listed assembly by UL.
- D. Surface Burning Characteristics:
 - 1. Textile Wall Coverings: Comply with one of the following:
 - a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84, NFPA 255, UL 723.
 - b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Manufacturers:
 - 1. G-P Gypsum Corp.
 - 2. National Gypsum Co.
 - 3. United States Gypsum Co.

2.2 COMPONENTS

- A. Studs and Tracks: ASTM C645; GA-216 and GA-600; galvanized sheet steel, 0.030-inch-thick, C shape, C-H shape 2X wood studs acceptable
- B. Furring, Framing, and Accessories: ASTM C645, GA-216 and GA-600.
- C. Gypsum Board Materials: ASTM C1396/C1396M; Type X fire resistant where indicated on Drawings.

1. Standard Gypsum Board: 5/8-inch-thick, maximum available length in place; ends square cut, tapered edges. Light-weight gypsum board not allowed
 2. Moisture Resistant Gypsum Board: 5/8-inch-thick, maximum available length in place; ends square cut, tapered edges.
 3. Exterior Gypsum Soffit Board: 1/2-inch-thick, maximum available length in place; ends square cut, square edges, dens glass gold.
 4. Gypsum Sheathing Board: 1/2-inch-thick, maximum available size in place; ends square cut, square edges; water repellent paper faces, dens glass gold.
- D. Tile Backer Boards:
1. Tile Backer Board: ASTM C1178; 5/8-inch-thick, maximum available length in place; ends square cut, tapered edges.

2.3 ACCESSORIES

- A. Gypsum Board Accessories: ASTM C1047; metal; corner beads, edge trim, and expansion joints.
1. Metal Accessories: Galvanized steel.
 2. Edge Trim: Type LC, L, U bead.
- B. Joint Materials: ASTM C475, GA-201 and GA-216, reinforcing tape, joint compound, and water. Light weight joint compound not allowed.
- C. Fasteners: ASTM C1002; Type S, GA-216; length to suit application.
- D. Adhesive: ASTM C557. GA-216.
1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- E. Gypsum Board Screws: ASTM C954, ASTM C1002; length to suit application.
1. Screws for Steel Framing: Type S.
 2. Screws for Wood Framing: Type W.
- F.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are ready to receive work.

3.2 INSTALLATION

- A. Metal Studs:
1. Install studs in accordance with ASTM C754, GA-216 and GA-600.
 2. Wood/Metal Stud Spacing: 16 inches oc.
 3. Partition Heights: Full height to structure above. Install additional bracing for partitions extending above ceiling.

- B. Wall Furring:
1. Erect free-standing metal stud framing tight to concrete, concrete masonry walls; attached by adjustable furring brackets. Erect horizontally.
 2. Space furring channels maximum 16 inches o.c., not more than 4 inches from floor and ceiling lines, abutting walls.
 3. Install furring as required for fire resistance ratings indicated.
- C. Ceiling Framing:
1. Install in accordance with ASTM C754 and GA-216.
 2. Coordinate location of hangers with other work. Install ceiling framing independent of walls, columns, and above ceiling work.
 3. Reinforce openings in ceiling suspension system interrupting main carrying channels or furring channels, with lateral channel bracing.
 4. Laterally brace entire suspension system.
- D. Acoustic Accessories:
1. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
 2. Install acoustic sealant within partitions.
- E. Gypsum Board:
1. Install gypsum board in accordance with GA-216 and GA-600.
 2. Fasten gypsum board to furring or framing with screws.
 3. Place control joints consistent with lines of building spaces as directed by Architect/Engineer.
 4. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
 5. Seal cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
- F. Joint Treatment:
1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 2. Feather coats onto adjoining surfaces so camber is maximum 1/32 inch.
 3. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
- G. Tolerances: Maximum Variation from Flat Surface: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09510
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes suspended metal grid ceiling system; and acoustic tile.

1.2 SYSTEM DESCRIPTION

- A. Provide system capable of supporting imposed loads with deflection limited to.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate ceiling layout.
- B. Product Data: Submit manufacturer's product data.
- C. Samples: Submit ceiling tile and suspension system.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Tile: Full-size units equal to 3 percent of amount installed for each type indicated, but not less than 10 sq. yd (8.3 sq. m).

1.5 QUALITY ASSURANCE

- A. Conform to CISCA requirements.
- B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 255 UL 723.
- C. Surface Burning Characteristics: Comply with the following when tested in accordance with NFPA 286.
 - 1. During 40 kW Exposure: No flame spread to ceiling.
 - 2. During 160 kW Exposure: No flame spread to perimeter of tested sample and no flashover.
 - 3. Total Smoke Release: Maximum 1,000 cu m.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity acoustic unit installation.

PART 2 PRODUCTS

2.1 SUSPENDED ACOUSTICAL CEILINGS

- A. Manufacturers:
 - 1. United States Gypsum Company
 - 2. Armstrong

2.2 COMPONENTS

- A. Grid:
 - 1. Non-Fire Rated Grid: ASTM C635, intermediate duty, non-fire rated, exposed configuration; components die cut and interlocking.
 - 2. Accessories: Stabilizer bars, clips, splices, edge moldings, hold down clips, required for suspended grid system.
 - 3. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
 - 4. Exposed grid surface width: 15/16 inch.
 - 5. Grid Finish: White color.
 - 6. Support Channels and Hangers: Galvanized steel, size and type to suit application and ceiling system flatness requirements specified.
 - 7. Seismic Hangers: Galvanized steel compression struts: Donn Corporation Series VSA or equal, size and type to suit seismic requirements.
- B. Acoustic Lay-In Tile:
 - 1. Size: 24 x 24-inches x 1-inh thick.
 - 2. CAC: 20 minimum
 - 3. Surface Finish: Washable servable impact resistant, scratch resistant, meeting USDA guidelines for use in food processing.
 - 4. Edge: Shadow Line
 - 5. Color: White
 - 6. Product: Equal to USG Halcyon Healthcare #98238 Class 'A', 0.95 NRC.

2.3 ACCESSORIES

- A. Acoustic Batt Insulation: ASTM C665, friction fit type, unfaced; 2-inch thick.
- B. Acoustic Sealant for Perimeter Moldings: Specified in Section 07900.
- C. Touch-up Paint: Type and color to match acoustic and grid units.
 - 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify layout of hangers does not interfere with other work.

3.2 INSTALLATION

- A. Suspension System:
 - 1. Install system in accordance with ASTM C636, ASTM E580.
 - 2. Coordinate location of hangers with other work. Where components prevent regular spacing of hangers, reinforce system to span extra distance.
 - 3. Hang system independent of walls, columns, ducts, pipes and conduit.
 - 4. Locate system on room axis [leaving equal border units according to reflected plan.
 - 5. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths.
- B. Acoustic Units:
 - 1. Install acoustic units level, free from damage, twist, warp or dents.
 - 2. Lay acoustic insulation above acoustic units for distance of 48 inches on both sides of acoustic partitions.
 - 3. Install hold down clips to retain panels tight to grid system within 20 ft of exterior doors.
- C. Tolerances: Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09770
SPECIAL WALL SURFACING
(FIBERGLASS REINFORCED PLASTIC PANELS)

PART 1 GENERAL

1.1 SUMMARY

- A. Provide fiberglass reinforced plastic (FRP) panels for wall (and ceiling) applications.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature, including product characteristics, accessories, and limitations.
- B. Selection Samples: Submit samples of colors and finishes if requested by architect.
- C. Verification Samples: Submit samples of selected materials specified to verify color and finish.
- D. Industry Certifications and Standards: Submit copy of documentation, indicating compliance.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 5 years' experience manufacturing similar products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty against defects in manufacturing.

PART 2 PRODUCTS

2.1 FIBERGLASS REINFORCED PLASTIC PANELS

- A. Manufacturer: Panolam FRP by Panolam Industries International, Inc., 1 Corporate Drive, Suite 725, Shelton CT 06484. Tel: 877-726-6526, Fax: 203-225-0050.
Web: www.panolam.com
Panels shall comply with the following:
 - 1. Classic Collection: White color
 - 2. Surface Texture: Embossed
 - 3. Fire Rating ASTM E 84: Class A
 - 4. Sustainability, Indoor Air Quality: GREENGUARD Gold Certification.

5. Thickness: 0.090 inches.
6. Barcol Hardness ASTM D2583: 35 typical
7. Water Absorption ASTM D570: 0.2 percent typical
8. Accessories: Color matched dividers, outside corners, inside corners, end caps and fastening rivets.
9. Adhesive: As recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals.
 1. Clean substrate of dirt, dust, waxes, and other bond breaking substances prior to beginning installation.
 2. Install panels with bottom edge located to clear top of resilient base.
 3. Apply adhesive uniformly using adhesive manufacturer's recommended trowel to the entire back of panels completely to the edge (100% coverage).
 4. Lay FRP panels in place, leaving approximately 1/8-inch between panels and 1/4-inch space top and bottom.
 5. Follow adhesive manufacturer's recommendations for set and application times.
 6. Apply pressure to entire panel face with laminate type roller, removing trapped air and ensure proper adhesive between surfaces.

3.3 ADJUSTING AND CLEANING

- A. Replace installations out of plumb and not aligned with adjacent panels and construction.
- B. Clean panel face to remove soiling, stains, dust, and dirt using clean rags and cleaning agents, as instructed by manufacturer.
- C. Leave installation clean, free of residue and debris, resulting from work of this section.
- B. 0 feet.

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints and other coatings.

1.2 SUBMITTALS

- A. Product Data: Submit data on finishing products.
- B. Samples: Submit paper chip samples, 3 x 5 inch in size illustrating range of colors available for each surface finishing product scheduled.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit coating maintenance manual including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.4 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84 and NFPA 255.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Store and apply materials in environmental conditions required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Approved Manufacturers:
 - 1. Coronado Paints.
 - 2. The Glidden Company.
 - 3. Sherwin Williams.
 - 4. Benjamin Moore.

2.2 COMPONENTS

- A. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of streaks or sags.
 - 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.

- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials required to achieve finishes specified.

2.3 EXTERIOR FINISHES

- A. Steel - Shop Primed, Galvanized:
 - 1. First Coat: Rust inhibiting primer.
 - a. Sherwin-Williams: Pro Industrial Pro Cryl Universal Primer, B66 Series
 - 2. Second and Third Coats: Acrylic enamel, semi-gloss.
 - a. Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66 Series

2.4 INTERIOR FINISHES

- A. Steel – Unprimed, shop primed, galvanized.
 - 1. First Coat: Rust inhibiting primer.
 - a. Sherwin-Williams: Pro Industrial Pro Cryl Universal Primer, B66 Series
 - 2. Second and Third Coats: Acrylic enamel, semi-gloss.
 - a. Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss, B66 Series
- B. Steel – Unprimed, shop primed, galvanized: Doors, handrails.
 - 1. First Coat: Rust inhibiting primer.
 - a. Sherwin-Williams: Pro Industrial Pro Cryl Universal Primer, B66 Series
 - 2. Second and Third Coats: Acrylic enamel, semi-gloss.
 - a. Sherwin-Williams: Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53 Series
- C. Plaster, Gypsum Board: Walls.
 - 1. First Coat: Latex primer sealer.
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28
 - 2. Second and Third Coats: Latex acrylic enamel, eggshell.
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series
- D. Plaster, Gypsum Board: High Performance Walls.
Note: For walls in high traffic, moisture or cleaning areas.
 - 1. First Coat: Latex primer sealer.
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28
 - 2. Second and Third Coats: Latex acrylic enamel, eggshell.
 - a. Sherwin-Williams: Pro Industrial Pre Catalyzed Waterbased Epoxy Eg-shel, K45 Series
- E. Plaster, Gypsum Board: Ceilings.
 - 1. First Coat: Latex primer sealer
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Primer, B28
 - 2. Second and Third Coats: Latex acrylic enamel, flat.
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Flat, B30 Series
- F. CMU.
 - 1. First Coat: Block filler
 - a. Sherwin-Williams: PrepRite Block Filler, B25 Series
 - 2. Second and Third Coats: Latex acrylic enamel, eggshell.
 - a. Sherwin-Williams: ProMar 200 Zero VOC Interior Latex Eg-shel, B20 Series

- G. CMU: High Performance. (Kitchen, Dishware, Serving, J.C.)
 - 1. First Coat: Block filler
 - a. Sherwin-Williams: PrepRite Block Filler, B25 Series
 - 2. Second and Third Coats: Latex acrylic enamel, eggshell.
 - a. Sherwin-Williams: Pro Industrial Pre Catalyzed Waterbased Epoxy, Eg-shel, K45 Series

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate conditions are ready to receive Work.
- B. Measure moisture content of porous surfaces using electronic moisture meter. Do not apply finishes unless moisture content is less than 12 percent.

3.2 PREPARATION

- A. Correct minor defects and clean surfaces affecting work of this section.
- B. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or applying finishes.
- C. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- D. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- E. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove foreign matter. Remove oil and grease with solution of tri-sodium phosphate, rinse well and allow to dry.
- F. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Clean surfaces with solvent. Prime bare steel surfaces.
- G. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

3.3 APPLICATION

- A. Sand wood and metal surfaces lightly between coats to achieve required finish.
- B. Where clear finishes are required, tint fillers to match wood.
- C. Prime concealed surfaces of interior woodwork with primer paint.
- D. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

- E. Finishing Mechanical And Electrical Equipment:
1. Refer to Mechanical and Electrical Sections for schedule of color coding, identification banding of equipment, duct work piping, and conduit.
 2. Color code items in accordance with color schedule. Color band and identify with flow arrows and names.
 3. Paint shop primed equipment.
 4. Remove unfinished louvers, grilles, covers, and access panels and paint separately. Paint dampers exposed behind louvers, grilles, convectors and baseboard cabinets to match face panels.
 5. Prime and paint insulated and exposed pipes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.
 6. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 7. Paint exposed conduit and electrical equipment occurring in finished areas.
 8. Paint both sides and edges of plywood backboards.
 9. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
- F. Cleaning: As work proceeds, promptly remove finishes where spilled, splashed, or spattered.

3.4 SCHEDULE - OF COLORS

- A. Refer to schedule of finishes, Sheet A3.0.

END OF SECTION

SECTION 10523

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire extinguishers; fire extinguisher cabinets; and brackets for wall mounting.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. Underwriters Laboratories Inc.:
 - 1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to NFPA 10 code.
- B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.
- C. Provide fire extinguisher cabinets classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, location and fire ratings.
- B. Product Data: Submit extinguisher operational features, color and finish and anchorage details.
- C. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install extinguishers when ambient temperature are capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Manufacturers:
 - 1. JL Industries.
 - 2. Larsen's Manufacturing Co.
 - 3. Potter Roemer.
- B. Dry Chemical Type: Cast steel tank, with pressure gage; Class A: B: C, Size 10.
- C. Extinguisher Finish: Steel, enamel to color as selected.

2.2 FIRE EXTINGUISHER CABINETS

- A. Manufacturers:
 - 1. JL Industries.
 - 2. Larsen's Manufacturing Co.
 - 3. Potter Roemer.
- B. Metal: Formed sheet steel, primed; 0.036 inch thick base metal.
- C. Configuration: Semi-recessed type, sized to accommodate accessories.
- D. Trim Type: Returned to wall surface, with 2 inch projection.
- E. Door: 0.016 inch thick, reinforced for flatness and rigidity; lock with break glass access.
- F. Door Glazing: Glass, clear, 1/8 inch thick float.
- G. Cabinet Mounting Hardware: Appropriate to cabinet.
- H. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim.
- I. Pre-drill for anchors.
- J. Hinge doors for 180 degree opening with continuous piano hinge. Furnish nylon catch.
- K. Weld, fill, and grind components smooth.
- L. Glaze doors with resilient channel gasket glazing.
- M. Finishing Cabinet Exterior Trim and Door: Primed for field paint finish.
- N. Finishing Cabinet Interior: Enamel.

2.3 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, galvanized white enamel finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install cabinets plumb and level in wall openings, maximum 48 inches from finished floor to top of extinguisher handle.
- B. Install wall brackets, maximum 48 inches from finished floor to top of extinguisher handle.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets, on wall brackets.
- E. Position cabinet signage as required by authorities having jurisdiction.

END OF SECTION

SECTION 10800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes toilet washroom accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.

PART 2 PRODUCTS

2.1 TOILET, BATH AND LAUNDRY ACCESSORIES

- A. Manufacturers:
 - 1. American Specialties, Inc.
 - 2. Bobrick.
 - 3. Bradley Corp.

2.2 COMPONENTS

- A. Products listed in Schedule are made by American Specialties, Inc., unless noted otherwise.
- B. Furnish two keys for each accessory to Owner. Master key accessories.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify exact location of accessories for installation.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site. Provide templates and rough-in measurements.
- B. See Section 06100 for installation of blocking in walls and ceilings.

3.3 INSTALLATION

- A. Install plumb and level, securely and rigidly anchored to substrate.
- B. Mounting Heights and Locations: As required by accessibility regulations and as indicated on Drawings.

3.4 SCHEDULES

- A. Waste Receptacle: Surface-mounted, 12 gallon 15-1/4" wide x 23" high x 8" deep, stainless steel equal to ASI 0826. Mounted under each hand sink in kitchen.
- B. Paper Towel Dispenser: Surface mounted, 400 'C' fold paper towel capacity, stainless steel, 11" wide x 14-1/4" high x 4-1/16" deep, equal to ASI 0210. Mounted over hand sink in kitchen per manufacturer's recommendations.
- C. Soap Dispenser: Surface mounted liquid soap dispenser, touch free, 34 oz. capacity, stainless steel. Equal to SASI 20364. Mounted adjacent to paper towel dispenser over each hand sink in kitchen.
- D. Mop Holder/Utility Shelf: Satin stainless steel with (3) mop holders, (2) bag hooks, 30" long, 8" shelf, equal to ASI 1315, mounted over janitor sink.

END OF SECTION

SECTION 11130

DOCK SEAL

PART 1 - GENERAL

- 1.1 CONDITIONS SPECIFIED ELSEWHERE: Section 010000 - General Requirements.
- 1.2 SUBMIT SHOP DRAWINGS showing overall dimensions (width, height).
- 1.3 SUBMIT 3 copies of manufacturer's Owner's Manual
- 1.3.1 **WARRANTY:** Proposals submitted without the following written warranties will be considered non-responsive.
 - 1.4.1 Dock Seal manufacturer shall provide with his bid a **written minimum 1-year parts and labor warranty**, detailed specification sheet with sizes, projection, range of trucks to be serviced and any other information necessary for proper installation and operation of the unit.
 - 1.4.2 Dock Seal parts not covered under warranty shall include: NONE
 - 1.4.3 In addition to all other warranties, the manufacturer shall warrant that the equipment will perform in a manner satisfactory to the Owner for a period of 36 months after date of installation. If Owner is not then satisfied with the performance of the equipment, the Owner may notify the manufacturer, and the manufacturer shall remove the equipment and refund the equipment purchase price to the Owner. This warranty shall be provided by the manufacturer in writing at time of bid.

PART 2 – PRODUCTS

- 2.1 Dock Seal shall be manufactured by Rite-Hite or an approved substitute. Shelter shall be sized by manufacturer to meet specific application requirements.
- 2.2 Dock Seal shall be 8'-0" overall width x 8'-0" overall height x 16' projection.
 - 2.2.1 Range of truck heights to be serviced shall be from 12' – 9" to 13' – 6".
 - 2.2.2 Range of truck widths to be serviced shall be from 7' – 0" to 9' – 0".
- 2.3 Beveled side pads shall provide a tight seal between the back of the trailer and the building wall.
 - 2.3.1 Bottom of side pads shall have slit breathers.
 - 2.3.2 Side pads shall be mounted on wood backer or optional galvanized TechSteel™ backer.
 - 2.3.3 Dock seal polyurethane foam shall be glued to backer.
 - 2.3.4 Side pads shall include flexible pressure panels that provide pressure against head curtain sealing edge when side pads are compressed by docked trailer.

- 2.5 Side pad and head curtain shall be 22 oz. base fabric with high-strength, friction-resistant fabric reinforcing.
- 2.6 Side pads shall have outboard guide stripes 24" high x 3.5" wide on side pad.

PART 3 – EXECUTION

- 3.1 INSTALLER shall examine the substrate and conditions under which shelter/seal is to be installed and notify the A/E and Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- 3.2 SHELTER/SEAL MANUFACTURER'S REPRESENTATIVE shall install shelter/seal in accordance with approved shop drawings and manufacturer's recommendations.
- 3.3 AFTER INSTALLATION is completed, a representative of the manufacturer shall examine the installation and require that all adjustments necessary to ensure proper operation of shelter/seal has been made. Before acceptance, an inspection shall be conducted in the presence of the Owner's representative to guarantee that the shelter/seal operates properly in every respect.

END OF SECTION

**SECTION 11160
HYDRAULIC DOCK LEVELERS**

PART 1 - GENERAL

- 1.1 CONDITIONS SPECIFIED ELSEWHERE: Section 010000 - General Requirements.
- 1.2 SUBMIT SHOP DRAWINGS showing pit dimension (length, width and depth), and anchorage of curb angle and embedded plates.
- 1.3 SUBMIT 3 copies of manufacturer's Owner's Manual, Maintenance Manual and Master Service Manual to the A/E. Also, provide manufacturer's maintenance video tape at same time.
- 1.4 WARRANTY: Proposals submitted without the following written warranties will be considered non-responsive. Standard warranty shall be 5 years parts and 1 year labor with an extended warranty as listed below.
- 1.4.1 This warranty is based on a standard fork lift truck operating procedure. A standard procedure is; no load shall exceed the rated lift capacity of the truck, and no load shall be pre-staged or stacked and pushed or pulled over the dock leveler into or out of the truck.
- 1.4.2 Dock leveler manufacturer shall provide with his bid a written 10-20 year money back warranty on dock levelers. Warranty shall be based on the following criteria:
- Gross weight of fork lift and load shall not exceed 10,000 lbs. (See attached fork lift truck wheel foot print data sheet.)
- User's operation shall not exceed _10_ full truckloads per 24-hour period over any one dock position.
- Lift truck speed shall be no more than 5 mph. Leveler grade shall be no more than the recommended grade as determined by the material handling equipment manufacturer and never more than 7.17%.
- 1.4.3 Dock leveler parts covered under the warranty shall include:
- | | |
|----------------------------|----------------------|
| Lip Assembly | Front Hinge Assembly |
| Rear Hinges and Hinge Pins | Platform Assembly |
| Front Hinge and Hinge Pins | Subframe |
| Base hydraulic – 10 years | |
| Hydra Rite – 10-20 years | |

PART 2 - PRODUCTS

- 2.1 HYDRAULIC DOCK LEVELERS shall be manufactured by Rite-Hite, or an approved substitute. Dock levelers shall be sized by the manufacturer to meet the warranty requirements specified herein.
- 2.1.1 Recessed adjustable dock levelers shall be 6 FEET wide x 8 FEET long, with a minimum 20" lip and a 10,000 lb capacity rating. Unit to have an operational range of 12" above and below dock level. Equip each unit with two (2), 12" high x 4" deep laminated dock bumpers.

- 2.1.2 Dock leveler shall meet ANSI MH30.1-2000 test load specifications with proper documentation from a 3rd party.
- 2.1.3 Platform shall have a minimum of (8) interior deck beams plus external working range toe guards with no more than 8" spacing between the beams.
- 2.1.4 When leveler is in stored position, the leveler lip will provide an integral and automatically-positioned, impact-rated, solid barrier 5" above building floor to help prevent accidental falls from vacant dock positions. **Unobstructed end loading shall be possible from below dock level.** Overlapping platform barriers or pinch points are not acceptable.
- 2.1.5 Levelers shall automatically return to safe, stored position if the trailer departs.
- 2.1.6 Automatic night locks to be integral part of manufacturer's standard dock levelers.
- 2.1.7 Full operating range telescoping toe guards to close off sides when leveler is in the highest upward position. Working range of 12".
- 2.1.8 Positive acting Safe-T-Strut™ maintenance support system will support lip and deck. This system must withstand a 10,000 lb. moving load and provide OSHA approved lock- out/tag-out capabilities.
- 2.1.9 Levelers shall have ramp flex of 4" to compensate for unlevel trailer beds. Rear hinges shall be fixed and shall not rise above floor level.
- 2.1.10 Dock leveler control box: All individual components, as well as the complete box unit, shall be UL-approved.
- 2.1.11 Control box shall include infinite lip control to extend the lip at any time during the operation of the leveler **AND** shall also provide a constant pressure emergency stop.
- 2.1.13 Leveler shall include brush style weatherseal.
- 2.1.14 Hydraulic fluid shall be biodegradable and have a pour point of -80 degrees below zero.

PART 3 - EXECUTION

- 3.1 INSTALLER shall examine the substrate and conditions under which dock levelers and truck restraints are to be installed and notify the A/E and Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- 3.2 DOCK LEVELER MANUFACTURER'S REPRESENTATIVE shall install dock levelers in accordance with approved shop drawings and manufacturer's recommendations. Location of dock levelers shall be indicated on drawings.

- 3.3 SHIM DOCK LEVELERS as necessary, weld into pit.
- 3.4 ADJUST UNITS to operate smoothly.
- 3.5 AFTER INSTALLATION is completed, a representative of the manufacturer shall examine the installation and require that all connections and adjustments necessary to assure proper operation of dock levelers be made. Before acceptance, a demonstration shall be conducted in the presence of the owner's representative to guarantee that all levelers operate properly in every respect. In addition, a detailed user/operator training session shall be conducted at time and place agreed upon by owner's representative and manufacturer's representative.

END OF SECTION

SECTION 11165

DOCK LIFT

PART 1 - GENERAL

- 1.1 Factory assembled Elevating Dock with electric-hydraulic power unit and operating controls and installation manual.
- 1.2 Product to conform to ANSI MH29.1-1994 – “Safety Requirements for Industrial Scissor Lifts.”
- 1.3 Related work specified elsewhere to include: Structural steel for pit steel curb angles per details supplied by elevating dock manufacturer, electrical for electrical requirements, and concrete for pit and related construction.

PART 2 - PRODUCTS

- 2.1 Elevating Dock shall be Rite-Hite Model LRL (Length) x (Width) as manufactured by Rite-Hite Corporation.
- 2.2 Lifting capacity 12,000 lbs. Capacity to be based on an evenly distributed load with single axle load capacity of 75% over ends and 50% over sides.
- 2.3 Platform size to be 6'-0" wide x 8'-0" long.
- 2.4 Unit Lowered Height 0, Raised Height 4'-0", Travel 4'-8".
- 2.5 8" long tapered safety toe guards to be provided on each platform side.
- 2.6 Bolt on guard/handrails 42" high with mid rail and 4" high safety kick plates to be provided on each long side.
- 2.7 12" long x 6'-0" wide piano hinged and split entry plate (lips), with lifting chains shall be provided on vehicle receiving (rolling) end of lift. Lip lifting chain storage hooks will be supplied on each guard rail end.
- 2.8 Safety chain with hooks provided across fixed end of lift.
- 2.9 Built-in hinged safety maintenance stop to be provided on base frame.
- 2.10 Nominal lifting speed to be 12 fpm with full load.
- 2.11 Nominal lowering speed factory adjusted to 15 fpm.
- 2.12 Unit to have grey enamel paint finish with safety striping on edges.

PART 3 - CONTROLS AND POWER SOURCE

- 3.1 Remote 5 HP power unit to include 25 feet of hydraulic hose from frame. Power unit to be TEFC with continuous duty designed motor and include a steel reservoir with external oil level site gauge and drain. Pressure relief, check, flow control and solenoid valves are to be supplied in aluminum manifold. In line and oil reservoir filters to be provided.
- 3.2 Remote handheld NEMA 4X push-button control to be provided with 25 feet of cord from power unit. Individual pushbuttons for up and down travel functions will be included.
- 3.3 Control box shall be NEMA 12
- 3.4 Control voltage shall be 24 volt.

PART 4 - CONSTRUCTION

- 4.1 Scissor leg mechanism to be high tensile structural steel tube.
- 4.2 Platform surface to be high tensile 55 KSI steel tread plate, minimum .25" thick.
- 4.3 Platform deck shall include positive retaining device at rolling end of lift to prevent platform separation from end frame in the event of uneven load distribution or external platform interference while lift is in lowering mode.
- 4.4 Entry/exit plates (lips) shall be of high tensile 55 KSI steel tread plate, with beveled entry/exit edges.
- 4.5 Scissor leg pivot points to be supplied with maintenance free DU type Teflon bushings.
- 4.6 Hydraulic cylinders to be chrome plated and polished, and include ground and chromed mounting pins. A return line from the hydraulic cylinders to the power unit shall be provided.
- 4.7 Rigid steel hydraulic tubing to be provided from cylinders and connect to main hydraulic hose having 4:1 safety factor.
- 4.8 Hydraulic safety velocity fusing shall be provided to prevent uncontrolled descent in event of hydraulic line failure.

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SECTION 11400

FOOD SERVICE EQUIPMENT

GENERAL

SUMMARY

Section includes food service equipment; and connections to utilities.

General:

1. Furnish and install all items of apparatus, equipment, materials and accessories indicated on Plans.
2. Furnish and install all items of equipment and materials, which are basically requisite to the installation of complete and satisfactorily operating systems.
3. The intent of the specifications is to outline or indicate work, or both, that cannot be readily shown on the drawings, and to indicate types and qualities of materials. The only exclusions are those marked on drawings generally as "Not in Contract" (N.I.C.) or as designated by other Contractor or by Owner.
4. Divisions into chapters and paragraphs are for convenience only. Contractor shall assign work to proper persons and no responsibility is assumed by the Architect because of interpretation of subject matter arrangement. Such specifications shall not operate to make the Architect an arbitrator to establish limit between Contractor and Sub-Contractor.
5. Specification by reference. When reference is made to specifications of a Manufacturer, trade association or similar source, such is made a part of these specifications and have the same force and effect as though reproduced herein, and on entering into a Contract, each Contractor acknowledges his familiarity with those pertaining to his work.
6. All items of equipment shall be delivered to site, assembled, attached and set in place at the building during regular working hours unless time schedule requirements necessitate otherwise, complete in every detail in accordance with the drawings and specifications ready to receive final connections by others. All items specified as manufacturer's standards shall include accessories as provided under manufacturer's descriptions. Where options are specified they shall be manufacturer's standard modifications or accessories.
7. The K.E.C. will be responsible for complete and satisfactory accomplishment of all work bearing on his trade. All crating and refuse involved in this work shall be disposed of by this Contractor. All equipment shall be in perfect condition, thoroughly cleaned, tested, oiled and adjusted at time of turning over to Owner for his acceptance.
8. The K.E.C. shall make arrangements at his own expense for receipt of and placing in storage area all shipments, with the General Contractor. Such shipments must be prepaid as there are no local funds available to pay transportation or other charges.
9. All fabricated equipment to be manufactured by one recognized and approved manufacturer of high quality Food Service Equipment for a period of ten (10) years having experience, personnel and plan facilities to insure uniformity of product and approval of Local, State and National Health & Dietary Authorities.
10. Any electrical disconnect switches and manual motor starters required by Code will be furnished and installed by Electrical Contractor. Electrical Contractor will wire from disconnect switch or starter to outlet box on equipment. All electrical accessories except for the above disconnect switches and manual starters will be furnished by equipment manufacturer. Equipment will be pre-wired from outlet box to magnetic starters and to other points. All motors ½ H.P. and larger shall be 120/240/460 volt, 1 or 3 phase. Unless otherwise noted, motors 1/3 H.P. and smaller shall be 120 volt, single phase. Cords and plugs when not furnished as manufacturer's standards, shall be provided by electrical contractor.

Related Work by Others:

11. In general, all utility rough-ins and final connections, as well as certain other special work which is listed hereinafter, will be performed by others in accordance with the following detailed requirements.
12. The K.E.C. shall furnish the installing trades with all information and assistance required for the proper installation of all equipment and/or components.
13. The work to be done by the Electrical Contractor relating to equipment in this section, unless noted otherwise on the drawings, shall include, but not be limited to the following:
 - a. General:
 - 1) Rough-in electrical service thru walls, floors and/or ceiling and run conduit and conductors from the rough in and make the connections to an approved terminal block, terminal panel or junction box on the equipment as furnished by the K.E.C. The K.E.C. to coordinate the work so as to make all final connections accessible.
 - 2) Verify in field all electrical outlets are located in walls, floor and ceiling. Where plug-in receptacles are required, the K.E.C. shall be responsible for all work beyond the receptacle.
 - 3) Verify in field disconnect switches are as required for the equipment in accordance with the electrical code.
 - b. Walk-in cooler/freezer:
 - 1) Wire from the timer mounted on compressor rack to the low temperature unit cooler coil mounted in the freezer compartment all as furnished by the K.E.C.
 - 2) Wire from junction box on unit cooler coils to room temperature thermostats and solenoid valve all as furnished by the K.E.C.
 - 3) Wire from the pre-wired lights and switch assembly to the additional ceiling lights all as furnished by the K.E.C.
 - 4) Wire from the function box on top of the cooler/freezer ceiling to the unit cooler coils all s furnished by the K.E.C.
14. The work to be performed by the Mechanical Contractor and/or Plumbing Contractor relating to equipment in this section, unless noted otherwise on the drawings, shall include, but not be limited to the following:
 - a. General:
 - 1) Rough-in waste, steam, gas and water lines thru the walls, floors and ceilings as shown on the drawings. Run waste lines from the rough-in and make the final connections on the equipment. Provide all traps and manifold and interconnect sink drains where shown. Run supply lines from the rough-in and make the connections to the equipment. Provide all traps, strainers, valves and vents required for proper installation.

REFERENCES

ASTM International:

15. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

Underwriters Laboratories Inc.:

16. UL - Electrical Appliance and Utilization Equipment Directory.

SUBMITTALS

Shop Drawings:

17. Within thirty (30) days after award of contract and before any equipment is purchased, the Kitchen Equipment Contractor shall submit to the Architect for approval six (6) bound brochures which will include a complete equipment list giving names of manufacturer's, trade names, catalog numbers, model numbers, illustrations and manufacturer's specification sheets on each item, properly numbered, and separate sheet for each item listing electrical, plumbing, ventilating, etc., connection requirements for said piece of equipment proposed. Two sets of bound service and parts manuals shall also be furnished before final acceptance.
18. Within thirty (30) days after Award of Contract, this Contractor shall submit to the Architect for his approval six (6) copies of shop drawings of all custom made items to be manufactured for this project naming the proposed Fabricator thereof. These drawings shall show the detail construction of each part of the equipment. No equipment shall be fabricated until drawings are approved by the Owner and Food Service Consultant.
19. The checking of these drawings and approval, of same does not relieve this Contractor of responsibility for errors or omissions, even though in accordance with approved drawings. If errors or omissions exist and are discovered later, they must be made good by this Contractor irrespective of any approval by the Owner or the Food Services Consultant.
The manufacturing of any equipment fitting between walls or between column and walls shall be withheld until actual field measurements can be taken or predetermined measurements set and approved by the General Contractor. All other items, which do not require field dimensions, may be manufactured upon approval of shop drawings.

Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

QUALITY ASSURANCE

Where applicable standards have been set, all equipment and accessories installed under this contract shall be manufactured and/or fabricated and installed in strict compliance with, and if applicable, bear the Seal of U.L., NEMA, ASME, NSF, AGA, OSHA and NFPA #96. Equipment, accessories and installation shall comply with all rules, regulations, codes and interpretations of the same.

QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 100 miles of Project.

Fabricator: Company specializing in performing Work of this section with minimum three years.

PRE-INSTALLATION MEETINGS

Convene minimum one week prior to commencing work of this section.

DELIVERY, STORAGE, AND HANDLING

Store products clear of floor in manner to prevent damage.

Coordinate size of access and route to place of installation.

COORDINATION

Coordinate Work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.

K.E.C. will supply to respective contractors all sink faucets, solenoid valves, siphon breakers, mounting adaptors, switches, controls, thermostats and /or other parts, fittings and devices not an attached integral part of Manufacturer's equipment for installation, as required.

Equipment must conform to building lines and be fitted neatly around obstructions, pipes, columns. Dimensions given are approximate on drawings and must be verified either bolted or field welded by K.E.C. on job site.

Sequence installation to accommodate required utility connections.

WARRANTY

The Kitchen Equipment Contractor shall deliver to the Architect, before Certificate of Payment will be issued, a written Guarantee covering all equipment and its installation for a period of one (1) year, and refrigeration compressor units for five (5) years after acceptance by Architect and/or Owner.

Should any defects in material or workmanship develop during the guarantee period, same shall be repaired or replaced without charge to Owner by this Contractor.

Service facilities shall be available for all Kitchen Equipment both during and after guarantee period. Service within the guarantee period shall include parts, labor, mileage and travel time at no-charge to the Owner.

PRODUCTS

COMPONENTS

Equipment Schedule: Refer to schedule at end of this section.

Furnish rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

All items of equipment for which national Sanitation Foundation has prescribed standards of construction must be constructed to conform with current standards and bear the N.S.F., U.L., A.S.M.E. AND A.G.A. Seals of approval.

General:

20. All materials shall be new without flaws or defects. All equipment items shall be designed, fabricated and installed in accordance with current National Sanitation Foundation Standards.

Stainless Steel: ASTM A666, Type 316 commercial grade, No. 4 finish.

Finish Hardware: Manufacturer's standard.

Service Outlet Covers and Escutcheons: Stainless Steel.

Sealants: Silicone, bacteria resistant type, as specified in Section 07900.

ELECTRICAL CHARACTERISTICS AND COMPONENTS

Electrical Characteristics: In accordance with the following:

21. 1/3, 3/4 and 2 hp.
22. 208-230 volts, single phase, 60 Hz.
23. 18.8 amperes maximum.

Motors: NEMA MG 1.

Disconnect Switch: Factory mount disconnect switch on equipment.

FABRICATION

Isolate rotating or reciprocating machinery to prevent noise and vibration.

Furnish indirect drain piping from equipment to terminate over nearest waste receptor.

Accommodate site installation of other services or equipment.

Shop assemble work where possible.

Provide indirect drain piping from equipment to terminate over nearest waste receptor.

Accommodate site installation of other services or equipment.

Stainless Steel Fastenings and Fittings: Bolt and screw with countersunk flat heads at visible or accessible surfaces. Use concealed fastenings where possible.

SHOP FINISHING

Shop finish components.

Stainless Steel: No. 4 finish.

EXECUTION

EXAMINATION

Verify ventilation outlets, service connections, and supports are correct and in required location.

Verify electric power is available and of correct characteristics.

EXISTING EQUIPMENT

Disconnect and move existing equipment being replaced.

Coordinate Work with Owner to minimize interruption to Owner's normal operations.

INSTALLATION

Insulate to prevent electrolysis between dissimilar metals.

Sequence installation and erection to accommodate required utility connections.

Cut, fit, and patch items of this section required for installation or services for equipment.

Cut and drill components for service outlets, fixtures, and fittings.

Use anchoring devices appropriate for equipment and expected usage.

Install sealant to achieve clean joint with adjacent building finishes and between abutting components.

MANUFACTURER'S FIELD SERVICES

At completion of work, demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.

Individual Performing Demonstration: Fully knowledgeable of operating and service aspects of equipment.

ADJUSTING

Adjust equipment and apparatus to ensure proper working order and conditions.

Remove and replace equipment creating excessive noise or vibration.

CLEANING

Remove masking or protective covering from stainless steel and other finished surfaces.

Wash and clean equipment.

Polish glass, plastic, hardware, accessories, fixtures, and fittings.

DEMONSTRATION AND TRAINING

Test equipment prior to demonstration. Demonstrate operation of components scheduled.

PROTECTION OF FINISHED WORK

Remove protective coverings from prefinished work.

EQUIPMENT SCHEDULE

ITEM # 1 **HOT FOOD WELL UNIT, DROP-IN, ELECTRIC**
Quantity: **Two (2) Manufacturer: Vollrath Model: 3640751**

Two (2) Model 3640751 Hot Food Well Unit, Drop-In, electric, (4) 12" x 20" individual 20 gauge stainless steel insulated wells, 54-3/4"W x 26"D x 21-1/2"H (overall), wet operation only, individual infinite controls mounted in panel with cord, power indicator light, drip-free flange, 1" copper manifold drain with individual well shutoffs & manifold shutoff, 18 gauge stainless steel top, 18 gauge galvanized exterior housing, includes positioning clips, 4000 watts, 208-240v/60/1- ph, 14.4-16.7 amps, cord with NEMA 6-30P, NSF, cULus, Made in USA (54"W x 25-1/4"D cutout size, requires 7/8" corner radius) (Refer to vollrathfoodservice.com for full warranty policy)

ITEM # 1 **HOT / COLD FOOD WELL UNIT, DROP-IN, ELECTRIC**
Quantity: **Two (2) Manufacturer: Vollrath Model: FC-6HC-03120**

Two (2) Model FC-6HC-03120 Hot/Cold Well, Drop-In, top mount, (3) pan, remote mountable panel with on-off switch, hot/cold toggle with indicator lights for hot or cold, thermostatic temperature rotary knob control in hot mode, preset cold control, manual manifold drain, 300 series stainless well & flange, galvanized wrapper, 625 watts per well, 15.6amp, 120v/60/1-ph, cord with NEMA 5-20P, cULus, NSF, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

ITEM # 2 **HAND SINK**
Quantity: **Five (5) Manufacturer: John Boos**
Model: **PBHS-W-1410-KV1MB-SS**

Five (5) Model PBHS-W-1410-KV1MB-SS Pro-Bowl Hand Sink, wall mount, 14"W x 10" front-to-back x 5" deep bowl, (1) centered splash mount faucet hole, gooseneck spout, single knee valve, 2" drain opening, includes basket drain & wall brackets, with left & right side splashes, all stainless steel construction, NSF, CSA-Sanitation (knee valve faucet included) Five (5) Model PB-MV Tempering Valve, manual temperature mixing valve with built in check valves, rough chrome finish, 9/16 -24 UNEF threads to accept 3/8" compression female hose fitting

ITEM # 3 **REACH-IN REFRIGERATOR**
Quantity: **One (1)** **Manufacturer:** **Hoshizaki** **Model:** **R2A-FS**

One (1) Model R2A-FS Steelheart Series Refrigerator, reach-in, two-section, 50.37 cu. ft., top mounted self-contained refrigeration, (6) epoxy coated wire shelves, (2) full height solid hinged doors, digital temperature display/controls, LED interior lighting, stainless steel exterior front & sides, stainless steel interior, (4) 4" heavy duty casters (2 with brakes), R290 Hydrocarbon refrigerant, 1/2 HP, NEMA 5-15P, cETLus, ETL-Sanitation

One (1) Warranty: 5-Year

labor on entire machine

One (1) Warranty: 6-Year

parts on entire machine

One (1) Warranty: 7-Year

parts on compressor One

(1) 115v/60/1-ph, 8 amps,

standard

One (1) Model HS-3558 Stainless Steel Bottom Support Universal Pan Slides (4 Pairs), Tray / Pan slides accommodate: (1) Baker Pan: 17-7/8"D to 18"D x 25-3/4"W to 26-7/8"W or (2) Hotel Pans: 12-7/8"D to 13"D x 20-3/4"W to 20-7/8"W, (16) Sets on 3" Centers per section is the recommended maximum capacity for uprights; units can hold as many as (24) sets on 2" centers per section

One (1) Casters, 4" (set of 4), standard

ITEM # 4 **SHELVING, WITH METAL FRAME**
Quantity: **Thirty-Two (32)** **Manufacturer:** **Metro**
Model: **MQ2460G**

Thirty-Two (32) Model MQ2460G Quick Ship - MetroMax® Q Shelf, 60"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

Thirty-Two (32) Model MX74P Quick Ship - Polymer trilobal post (compatible with MetroMax® i, MetroMax® 4, MetroMax® Q), 74-3/16"H, for stationary use or with a dolly, adjustable leveling foot, grooved on 1" increments, corrosion proof all polymer construction, NSF

ITEM # 5 **THREE (3) COMPARTMENT SINK**
Quantity: **One (1)**
Manufacturer **John Boos**
Model: **43PB1824-2D30**

One (1) Model 43PB1824-2D30 Pro-Bowl Sink, 3-compartment, 117-1/4"W x 29-1/2"D x 44-1/16"H overall size, (3) 18"W x 24" front-to-back x 12" deep compartments, (2) 30" left & right drainboards, 10"H boxed backsplash with 45° top and 2" return, (1) set of splash mount faucet holes with 8" centers, 3-1/2" die-stamped drain opening, 14/300 stainless steel construction, stainless steel legs, adjustable front & side bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

One (1) T&S Brass Model B-0133-01 EasyInstall Pre-Rinse Unit, mixing faucet, 8" wall mount, 14" add-on 063X swing nozzle, 18" riser, overhead spring, lever handles, 56" flex hose, Eterna cartridges, spray valve (B-0107), 9" wall support (B- 0109-02), 1/2" male NPT, EPA2005 Compliant

One (1) T&S Brass Model B-1105-KIT Inlet Kit, 1/2"NPT close elbows, 24" flex supply hoses
 Three (3) Model PB-LWR-1 Twist Handle Lever Waste, for 3-1/2" industry standard sink opening, standard valve, basket strainer (includes an adapter for either 2" or 1-1/2" drain outlet)

ITEM # 6 **DISHTABLE, SOILED**
Quantity: **One (1)**
Manufacturer: **John Boos Model: CUSTOM**

One (1) Model CUSTOM "L" Shaped 14ga Stainless Steel Soiled Dishtable, Sized and shaped as per drawing

One (1) T&S Brass Model B-0455 Vacuum Breaker Unit, 1/2" IPS piping, slip flanges for mounting on 45° surface, 6" between piping

One (1) T&S Brass Model B-0133-B EasyInstall Pre-Rinse Unit, wall mount. base faucet with spring check cart. & lever handles, 2" dia. flanges with 1/2" NPT female eccentric flanged inlets, 35-1/2"H, 15" overhang, 8-1/4" clearance, 18" riser, (B-0107) spray valve, B-0044-H flex stainless steel hose, 6" wall bracket, quarter-turn Eterna cartridges, low lead

One (1) T&S Brass Model B-0230-KIT Inlet Kit, 1/2" NPT nipple, close elbows, 24" flex supply hoses

ITEM # 7 **DISHWASHER, CONVEYOR TYPE, VENTLESS**
Quantity: **One (1)**
Manufacturer: **Champion**
Model: **44 PRO-VHR**

One (1) Model 44 PRO-VHR Pro Series, 44"W rack conveyor dishwasher, ventless heat recovery technology, proportional rinse, progressive anti-jam drive system, top mounted control panel with HMI user interface, Proactive maintenance software, 100 gallons per hour with energy sentinel (idle pump shut-off), (209) racks per hour, built-in 70° rise booster, electric tank heat, single-piece hood design, single-piece stainless steel upper & lower wash arms manifolds, single removable scrap screen per tank, 20" standard vertical clearance which accommodate 18" x 26" sheet pans, full 180° opening leak proof insulated hinged access doors, automatic tank fill, door safety switches, leak-proof ball valve drains, lower front & side enclosure panels, stainless steel heavy gauge construction including base & legs, electric tank heat, 2 HP wash pump, single point machine & separate booster connection, vent fan control, stainless steel rear manifolds, includes: (2) 20" x 20" peg racks & (1) 20" x 20" flat rack, NSF Pot & Pan mode, CULus, ENERGY STAR®, Made in USA (consult factory for price)

One (1) Model DRNTEMP Drain Line tempering kit

ITEM # 8 **CLEAN DISHTABLE**
Quantity: **One (1)**
Manufacturer: **John Boos**
Model: **CDT4-S96SBK-L**

One (1) Model CDT4-S96SBK-L Pro-Bowl Clean Dishtable, straight design, 96"W x 30"D x 44"H overall size, right-to-left operation, 10"H boxed backsplash with 45° & 2" return, 2-1/4"H rolled edge, 14/300 stainless steel top, stainless steel legs, bracing, & adjustable bullet feet, NSF

One (1) Model PB-SRW-42 Sorting Shelf, 42"W x 15-3/8"D X 16-1/2"H, holds (2) racks, wall mounted, solid, includes brackets, 18/300 stainless steel, NSF

One (1) Model CDT4-LS60SSK Dishtable Undershelf, 53-5/8"W x 24-1/8"D, 14/300 stainless steel shelf, 16 ga. stainless steel legs with adjustable bullet feet, NSF

ITEM # 9 **DISPOSER**
Quantity: **One (1)**
Manufacturer: **Salvajor**
Model: **200-CA-18-ARSS**

One (1) Model 200-CA-18-ARSS Disposer, 18" cone assembly, 2 Hp motor, start/stop push button, drain/flush/time delay, automatic reversing & water saving ARSS control, includes fixed nozzle, chrome plated vacuum breaker, solenoid valve, scrap ring & flow control, 6-1/2" inlet diameter, heat treated aluminum alloy housing, UL, CE

One (1) 208v/60/1-ph, 12.1 amps

One (1) Model 980105 Mounting bracket for ARSS-2, ARSS, ARSS-LD & WSP

ITEM # 10 **BEVERAGE COUNTER**
Quantity: **One (1)**
Manufacturer: **John Boos**
Model: **BEVERAGE**

Beverage Counter size and shape as per drawing

One (1) BK Resources Model BK-MIB-2411 Mobile Ice Bin, with sliding lid, 11"W x 24"D x 29"H, stainless steel, 53lb. capacity, removable bottom tray, drain valve in rear of unit, 3" casters with brake

ITEM # 11 **ICE MAKER, CUBE STYLE**
Quantity: **One (1)**
Manufacturer: **Ice-O-Matic**
Model: **CIM0530HA**

One (1) Model CIM0530HA Elevation Series™ Modular Cube Ice Maker, air-cooled, self-contained condenser, dual exhaust top/side air discharge, 30" W, approximately 561 lb production/24 hours at 70°/50° (432 lb at 90°/70°), half-size cubes, PURE ICE® built-in antimicrobial protection, LED status display, one touch sanitize/descaling controls, dishwasher safe food zone components, cULus, NSF, CE, BPA Free

One (1) 115v/60/1-ph, 17.8 amps, standard

One (1) Model B55PS Ice Bin, 510 lb storage capacity, 30"W x 31"D x 50"H, top-hinged, slope front door, for top-mounted ice maker, polyethylene interior, durable aluminum exterior, 6" legs, NSF

One (1) Model IFQ1-XL Water Filter Manifold, single filter designed for ice makers producing between 850 & 1050 lb (386.3 to 476.3 Kg.) of ice per day, 2.25 gpm maximum flow rate, IsoNet® scale inhibitor, .5 micron particle reduction, quick connect fittings (water filters must be changed every 180 days (6 months), at a minimum)

ITEM # 12 **KITCHEN WALK-INS**
Quantity: **One (1)**
Manufacturer: **Bally Refrigerated Boxes**
Model: **WALK-INS**

One (1) Model WALK-INS Walk-in 2- coolers/1-freezer to include: insulated floors, walls and ceiling panels for a approximate 24' x 16' x 8'-6" tall walk-in, three doors, refrigeration packages, assembly, installation, refrigeration piping/charging, permits and start-up. Per Bally project #40625-001-R02-HD

Eighty (80) Metro Model MQ2460G Quick Ship - MetroMax® Q Shelf, 60"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

Ninety-Two (92) Metro Model MX74P Quick Ship - Polymer trilobal post (compatible with MetroMax® i, MetroMax® 4, MetroMax® Q), 74-3/16"H, for stationary use or with a dolly, adjustable leveling foot, grooved on 1" increments, corrosion proof all polymer construction, NSF

Eight (8) Metro Model MQ2436G Quick Ship - MetroMax® Q Shelf, 36"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF

Four (4) Metro Model MQ2448G Quick Ship - MetroMax® Q Shelf, 48"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF

ITEM # 13 **CABINET, ENCLOSED, BUN / FOOD PAN**
Quantity: **Eight (8)**
Manufacturer: **Cambro**
Model: **UPC1600HD110**

Eight (8) Model UPC1600HD110 Ultra Camcart® Food Pan Carrier, front loading, one-piece double wall polyethylene shell, foam insulation, holds (24) 2-1/2" deep full size pans, (16) 4" deep full size pans, (12) 6" deep full size pans, (8) 8" deep full size pans, approximate capacity 120 qt., molded-in handles & bumpers, nylon latch, air-tight gasket, vent cap, (4) heavy duty 6" casters (2 fixed, 2 swivel with brakes), black, NSF

ITEM # 14 **EXHAUST HOOD**
Quantity: **One (1)** **Manufacturer:** **Captive-Aire**
Model: **VENTILATION SYSTEM**

One (1) Model VENTILATION SYSTEM 24' Exhaust hood and ventilation system - as per CaptiveAire Systems project #6113852. FSEC to include freight , delivery to the job site, installation and start-up of the fire suppression system. Installation of the remainder of the ventilation system is by others.

ITEM # 15 **CONVECTION OVEN, GAS**
QUANTITY **Two (2)**
Manufacturer: **Blodgett**
Model: **ZEPH-100-G DBL**
Quantity: **Two (2)**
Manufacturer: **Blodgett**
Model: **ZEPH-100-G DBL**

Two (2) Model ZEPH-100-G DBL Zephair Convection Oven, gas, double-deck, standard depth

Two (2) Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

Two (2) Dormont Model PS (PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack

ITEM # 16 **RANGE, 36", 4 OPEN BURNERS**
Quantity: **One (1)**
Manufacturer: **Southbend**
Model: **4367D**

One (1) Model 4367D Ultimate Restaurant Range, gas, 36", (4) pyromax burners, standard grates, standing pilot, (1) standard oven with battery spark ignition, includes (1) rack, 22-1/2" flue riser with shelf, stainless steel front, sides, shelf & 6" adjustable legs, 205,000 BTU, CSA, NSF (Note: Qualifies for Southbend's Service First™ Program, see Service First document for details)

One (1) Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial

PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

One (1) Dormont Model PS (PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack

One (1) Natural Gas

One (1) Casters, 2 locking & 2 standard, in lieu of legs

ITEM # 17 **CONVECTION STEAMER, ELECTRIC, BOILERLESS**
Quantity: **One (1)**
Manufacturer: **AccuTemp**
Model: **S62083D100 DBL**

One (1) Model S62083D100 DBL Two Steam'N'Hold™ Boilerless Convection Steamer, includes stand with casters, electric, holds (6) 12" x 20" x 2-1/2" deep pans each compartment, vacuum cooking, manual mechanical timer controls, NO water or drain connections required, 10kW, (2) 208/60/3ph, 28 amps, (2) 5' cords & NEMA L15-30P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®

ITEM # 18 **EXISTING EQUIPMENT**
Quantity: **One (1) Manufacturer:**
 Existing Equipment

One (1) Tilt Skillet - Existing Equipment - FSEC to relocate

ITEM # 19 **GAS FLOOR FRYER**
Quantity: **Three (3)**
Manufacturer: **Pitco Frialator**
Model: **SG18-S**

Three (3) Model SG18-S Essentials Fryer, Solstice™ Fryer, gas, floor model, full frypot, 70-90 lb. oil capacity, millivolt control ONLY, stainless steel tank, front, door & sides, 140,000 BTU, NSF, CE, CSA Flame, CSA Star, AuGA (free standing, stand alone only fryer - special price) (Cannot be configured for use with other controllers, accessories or options)

Three (3) Dormont Model 1675KIT48 Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) full port valve, (2) 90° elbows, coiled restraining cable with hardware, 180,000 BTU/hr minimum flow capacity, limited lifetime warranty

Three (3) Dormont Model PS (PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack

Three (3) Natural gas

One (1) Model P18 Fryer Filter, mobile, 75 lb. oil capacity, 18 gauge stainless steel lift-cover, low-profile design, with pump & hose assembly, stainless steel, for use with all 18 size fryers, CSA, NSF, UL, CE

Two (2) John Boos Model EFT8-3018SSK-X Filler Table, 18"W x 30"D x 36-1/4"H overall size, 18/430 stainless steel top with 1-1/2" backsplash, Stallion Safety Edge front, 90° turndown on sides, stainless steel legs & adjustable undershelf, plastic bullet feet, NSF, KD (Available in Effingham and Nevada)

ITEM # 20 **EXISTING EQUIPMENT**
Quantity: **Two (2)**
Manufacturer: **Existing Equipment**

Two (2) Work Table -Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 21 **EXISTING EQUIPMENT**
Quantity: **One (1)**
Manufacturer: **Existing Equipment**

One (1) Enclosed Base work table - Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 22 **EXISTING EQUIPMENT**
Quantity: **One (1) Manufacturer:**
 Existing Equipment

One (1) Work Table Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 23 **EXISTING EQUIPMENT**
Quantity: **One (1) Manufacturer:**
 Existing Equipment

One (1) Work Table - Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 24 **EXISTING EQUIPMENT**
Quantity: **One (1)**
Manufacturer: **Existing Equipment**

One (1) Mixer - Existing Equipment - FSEC to relocate

ITEM # 25 **WORK TABLE, WITH PREP SINK(S)**
Quantity: **One (1)**
Manufacturer: **John Boos**
Model: **EPT6R5-3060SSK-L**

One (1) Model EPT6R5-3060SSK-L Work Table With Prep Sink, 60"W x 30"D x 40-3/4"H overall size, (1) 16"W x 20" front-to- back x 12" deep sink bowl on left, 5"H backsplash, includes 10" swing spout faucet 4" O.C., 16/300 stainless steel top, stainless steel legs & adjustable undershelf, 1" stainless steel adjustable bullet feet, NSF, CSA-Sanitation, KD
One (1) T&S Brass Model B-0325 Mixing Faucet, deck mount, 4" adjustable centers, 6" swivel gooseneck spout with Series 1 stream regulator outlet (includes lock washer to convert to rigid), lever handles with color-coded indexes, quarter-turn Eterna compression cartridges with spring checks, polished chrome-plated brass body & tubular spout, 1/2" NPT female inlets, low lead, cCSAus, ADA Compliant(replaces B-0326)

One (1) T&S Brass Model B-0425-KIT Inlet Kit with 24" supply hoses, Nipples, Washer and Locknuts that provide 1/2" NPT male outlet and 3/8" female compression inlet. Certified to ASME A112.18.1/CSA B125.1, NSF 61-Section 9 and NSF 372.

ITEM # 26 **EXISTING EQUIPMENT**
Quantity: **One (1)** **Manufacturer:**
 Existing Equipment

One (1) Prep table Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 27 **POTATO PEELER**
Quantity: **One (1)**
Manufacturer: **Blakeslee**
Model **XC-60T**

One (1) Model XC-60T Potato/Vegetable Peeler, floor-type, 50 to 60 lbs. capacity, discharge chute, adjustable 0 to 5 minute timer, triple v-belt drive, cast aluminum abrasive disc, deluxe stainless steel peel trap strainer basket, hinged door, stainless steel construction, 1 HP

One (1) 115v/60/1-ph, standard

ITEM # 28 **EXISTING EQUIPMENT**
Quantity: **One (1)**
Manufacturer: **Existing**
Equipment

One (1) Work Table Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 29 **EXISTING EQUIPMENT**
Quantity: **One (1) Manufacturer:**
 Existing Equipment

One (1) Work Table Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 30 **WORK TABLE, 84", STAINLESS STEEL TOP**
Quantity: **Two (2)**
Manufacturer: **John Boos**
Model: **ST4-3084SSK**

Two (2) Model ST4-3084SSK Work Table, 84"W x 30"D, 14/300 stainless steel flat top, with Stallion Safety Edge front & back, 90° turndown on sides, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD Four (4) Model DR2020SC-S30 Drawer, for 30"D work tables, 20"W x 20" front-to-back x 5" deep, stainless steel front & drawer pan, self closing, roller bearing slides, NSF, for stainless steel table tops only

Two (2) Model CAS02-R Casters, 5", heavy duty, locking, for 1-5/8" diameter legs (set of 6)

ITEM # 31 **FLOOR TROUGH**
Quantity: **One (1)**
Manufacturer: **John Boos**
Model: **FTFG-1860-X**

One (1) Model FTFG-1860-X Floor Trough, 60"W x 18"D, subway-style fiberglass grating, 4" deep all-welded drain pan with built-in pitch, accommodates up to a 4" diameter pipe, includes stainless steel removable perforated strainer, 14/300 stainless steel (Available in Effingham and Nevada)

ITEM # 32 **EXISTING EQUIPMENT**
Quantity: **One (1)**
Manufacturer: **Existing Equipment**

One (1) Hot food table - Existing Equipment - FSEC to relocate

ITEM # 33 **EXISTING EQUIPMENT**
Quantity: **Two (2)**
Manufacturer: **Existing Equipment**

Two (2) Work Table - Existing Equipment - FSEC to relocate and Refurbish as needed

ITEM # 34 **EXISTING EQUIPMENT**
Quantity: **Two (2) Manufacturer:**
 Existing Equipment

Two (2) Undercounter Refrigerator - Existing Equipment - FSEC to relocate

ITEM # 35 **SHELVING, WITH METAL FRAME**
Quantity: **Sixteen (16)**
Manufacturer: **Metro Model: MQ2460G**

Sixteen (16) Model MQ2460G Quick Ship - MetroMax® Q Shelf, 60"W x 24"D, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner releases, (4) wedge connectors, Microban® antimicrobial product protection, 600 lb. capacity per shelf, NSF

Sixteen (16) Model MX74P Quick Ship - Polymer trilobal post (compatible with MetroMax® i, MetroMax® 4, MetroMax® Q), 74-3/16"H, for stationary use or with a dolly, adjustable leveling foot, grooved on 1" increments, corrosion proof all polymer construction, NSF

ITEM # 36 **EXISTING EQUIPMENT**
Quantity: **One (1)**
Manufacturer: **Existing Equipment**

One (1) Coffee Maker Existing Equipment - FSEC to relocate

ITEM # 37 **MOBILE HEATED CABINET**
Quantity: **Two (2)**
Manufacturer: **FSHC-12W1-120-QS**

Two (2) Model FSHC-12W1-120-QS (QUICK SHIP MODEL) Flav-R-Savor® Humidified Holding Cabinet, single Lexan® door, (12 pair) universal slides 3" OC adjustable on 1-1/2" OC, stainless steel construction, 5" swivel casters (two swivel with wheels locks, two rigid), 120v/60/1-ph, NSF, cULus

ITEM # 50 **REFRIGERATED - WAREHOUSE**
Quantity: **One (1)**
Manufacturer: **Bally Refrigerated**
Boxes Model: **WALK-INS**

One (1) Model WALK-INS Walk-in cooler/freezer warehouse to include: insulated walls and ceiling panels for an approximate 35' x 50' x 12' tall walk-in, two mechanical sliding doors, refrigeration packages, assembly, installation, refrigeration piping/charging, permits, and start-up. Per Bally project #40625-002-R02-HD

END OF SECTION

INDEX OF SPECIFICATION SECTIONS

SECTION

TITLE

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MAI: 2024-2701

SECTION 21 05 00

FIRE PROTECTION REQUIREMENTS

PART 1 GENERAL

1.1 RELATED SPECIFICATIONS AND DOCUMENTS

- A. Drawings and related specifications for this project including General and Supplementary Conditions, Division 1, General Requirements, Instructions to Bidders, Addenda's, etc. apply to and are considered a part of Division 21 – Fire Suppression Work.
- B. Information in this division is intended to clarify or make additions to the requirements set forth in the General Conditions, Supplementary Conditions, and Division I of these specifications. Any conflict between this Division 21 and other sections or divisions of the specifications or drawings shall be brought to the attention of the Architect/Engineer in writing as a request for addendum prior to the bid opening.
- C. Furnish all equipment, materials, articles, items, operations or methods listed, mentioned or scheduled on drawings, these specifications, manufacturer's installation instructions and include all labor, materials, equipment and incidentals necessary for their complete installation and operation.
- D. All information contained in this section applies to all sections within Division 21 as if it was part of each section.

1.2 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are intended to supplement each other and any material or labor called for in one shall be furnished even if not specifically mentioned in both. Any material or labor which is neither shown on the drawings nor listed in this specification, but is normally incurred or required for completion of work shall be furnished. If there is a discrepancy between the drawings and specifications, the more stringent of the two shall be followed.
- B. Drawings are diagrammatic and are intended to show approximate location and general arrangement of systems and equipment. No attempt has been made to show every ell, tee, etc. Drawings shall not be scaled for location of systems, equipment, etc. All dimensions whether given on drawings or scaled shall be verified in field and coordinated with all other trades and existing field conditions. Some ductwork, piping, equipment, etc. locations may require changes in location due to field conditions and coordination with other trades will be made with no additional cost to the Owner. Failure to check will be no reason for additional compensation.
- C. These drawings and the associated specifications are intended to provide a complete furnishing, installation and operational fire protection systems. If these drawings and associated specifications have information omitted that would not allow a completely operational system as is the intent of the Engineer, the bidder shall notify the Engineer a minimum one week prior to the bid date to allow for addenda. Once bids have been received, the Contractor shall be responsible for

material, labor, etc., to furnish and install a completely operational mechanical system as is the intent of these drawings and associated specification.

- D. The installation of all systems, equipment, etc., is subject to clarification with submitted shop drawings and field coordination requirements. Equipment outlines shown on drawings or dimensioned on drawings are limiting dimensions. Any equipment that reduces the indicated clearances or exceeds specified or scheduled equipment dimensions shall not be used.
- E. All sprinkler system pipe routing, sprinkler head locations, etc. shall be approved by the Architect in a schematic layout prior to starting shop drawings. The Architect/Engineer and Owner reserve the right to make minor changes in the location of equipment, piping, ductwork, etc. at the time of rough-in without additional cost to the Owner.
- F. The Fire Protection Contractor shall have completed for his portion of work, at least one installation of size and type comparable to this project and has been in satisfactory operation for at least two complete years. The Fire Protection Contractor shall also have a developed service department capable of negotiating service contracts with the Owner for systems herein specified.

1.3 AUTOCAD BACKGROUND FILES

- A. The Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$150.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Contractor.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.5 LOCAL CONDITIONS

- A. Before submitting proposals, each contractor shall examine these specifications and associated drawings, addenda, etc. and shall examine the site of the project. The bidder shall fully investigate the site of this project, investigate coordination of his work with all other trades and existing conditions and completely satisfy himself as to the conditions to which the work is to be performed before submitting his/her bid. No allowances or considerations will be given at a later date for alleged misunderstanding as to the requirements of the work, materials to be furnished, or conditions required by the nature of this project site and coordination by the neglect on the bidder's part to make such an examination and coordination.
- B. Drawings may show approximate location of existing services. The Fire Protection Contractor shall check with local utility companies or municipal agencies for exact location of services which they expect to encounter. The Fire Protection Contractor shall be responsible for hiring a company such as "Miss Dig" to stake out and locate all utilities in areas of excavation before commencing any work. The Fire Protection Contractor shall verify all elevations and locations of existing underground lines which are to be connected into or routed over or under. This verification shall be done prior to beginning work at this project.

1.6 QUALITY ASSURANCE

- A. Sprinkler Systems: Perform work to NFPA 13.
- B. Standpipe and Hose Systems: Perform to NFPA 14.
- C. Welding Materials and Procedures: Perform to ASME Code.
- D. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.7 SUBMITTALS

- A. Furnish electronic sets of complete detailed Computer Aided Design (CAD) working drawings, hydraulic calculations, equipment shop drawings and product data of the system.
- B. Preliminary Shop Drawings: Prior to detailed submission, submit preliminary layout of finished ceiling areas indicating only head locations coordinated with ceiling installation on a Computer Aided Design (CAD) background. In areas of

exposed piping, submit a preliminary layout showing pipe routing. Preliminary layouts shall be approved by the Architect prior to detailed shop drawing submission.

- C. Shop Drawings: Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories. Indicate system controls. Submit actual flow test results, with name of witness from proper local authorities attending, on shop drawings. Hydraulic calculations must be based on actual flow test results.
- D. Product Data: Provide data on sprinkler heads, valves and specialties, including manufacturers catalog information. Submit performance ratings rough-in details, weights, support requirements, and piping connections.
- E. Samples: Submit two of each style of sprinkler head specified.
- F. Provide tests and documentation as required by the Fire Marshal
- G. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.
- H. The Fire Protection Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. At a minimum \$100.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use.

1.8 SCOPE OF WORK

- A. Design and provide an automatic sprinkler and standpipe system for all portions of the building. Furnish and install all piping from city service valve to fire service area including service tee, domestic curb valve, hydrant curb valve, fire hydrant post indicator valve, detector check valve, alarm check valve with retarding chamber and pressure switch, OS & Y valves with supervisor switches, check valves, pump test connection, fire department connection, jockey pump, fire pump, air compressor, controllers, interior piping, sprinkler and accessories and appurtenances for complete systems as shown on drawings and hereinafter specified. Also furnish and install double check valve back-flow prevention assembly. See drawings. (Some items mentioned in this section may not be required for this project - coordinate required equipment with drawings and NFPA Codes and regulations).
- B. The entire installation shall be strictly in accordance with NFPA Standard No. 13, Sprinkler Systems, NFPA Standard No. 14 installation of standpipe and hose systems, NFPA Standard No. 20, installation of centrifugal fire pumps, and NFPA Standard No. 24 installation of private fire service mains, NFPA 70 National Electric Code, and shall meet the requirements of the Owners insurance carrier, governing Fire Marshal and all other authorities having jurisdiction. Note: extended coverage sprinkler head system will not be accepted without written approval from the Engineer.

- C. Systems shall be hydraulically designed, detailed, furnished and installed by a competent, experienced and licensed Fire Protection Contractor regularly engaged in furnishing and installing fire protection systems.
- D. Contractor shall furnish preliminary system layout drawings and after approval, complete detailed Computer Aided Design (CAD) working drawings, hydraulic calculations and equipment shop drawings of the system and shall submit them to the Owners insurance carrier and governing Fire Marshal for their review and approval. Shop drawings shall bear designers/installers State of Michigan License number and Certification number, and have approval of Fire Marshall before being submitted to the Engineer. Eight copies of approved drawings, calculations, shop drawings and product data shall be submitted to Architect/Engineer for review. No work shall be commenced before shop drawings are reviewed by Architect/Engineer.
- E. Contractor shall examine the drawings to determine building construction which would affect location of mains and heads.
- F. All permits, licenses, fees, inspections and arrangements required for the work under this contract shall be obtained and paid for by the contractor. Documentation shall be provided as required by the State Fire Marshal.
- G. At completion of the project, the Fire Protection Contractor shall clean, lubricate and operate all control valves, alarms and devices. Provide Owner with two copies of NFPA Standard No. 25 on inspection, testing and maintenance of water based fire protection systems and maintenance and parts lists for all equipment installed. Install hydraulic design plate on sprinkler riser as per Section 10-5 and provide spare sprinkler heads with wrenches in wall mounted box near riser as per Section 3-2.9 in the 1999 edition of NFPA 13.
- H. Contractor shall be responsible for total system design and layout of sprinkler heads and piping.
- I. Contractor shall be responsible for obtaining all volume, pressure and flow test data from local water supply system necessary to allow a complete bid price and approved final design and installation.
- J. It shall be the responsibility of the Fire Protection Contractor to verify the fire protection water service size noted on the drawings and shall be responsible for notification of any changes in pipe size to the General Contractor (or Owner) prior to the bid date, that is required to accomplish a complete, operational and code approved system.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit Maintenance Instructions: Include installation instructions, spare parts lists, procedures, and treatment programs.

1.10 QUALITY ASSURANCE

- A. Sprinkler Systems: Perform work to NFPA 13.

- B. Standpipe and Hose Systems: Perform to NFPA 14.
- C. Welding Materials and Procedures: Perform to ASME Code.
- D. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Fire Protection Contractor shall be licensed and certified by the State of Michigan for the design and installation of fire protection standpipe, hose and sprinkler systems.

1.11 RECORD DRAWINGS

- A. Maintain an up-to-date set of "record" drawings showing actual piping, sprinkler heads, etc. installation locations. Exact dimensions from column lines for all concealed work and tie-ins with elevations noted shall be included.
- B. Include a set of reproducible drawings and a set of prints in each Operation and Maintenance Manual.
- C. The Engineer reserves the right to request and be furnished any additional information he deems necessary to be shown on the record drawings.

1.12 OWNER'S INSTRUCTIONS

- A. Upon completion of the project, the contractor shall be responsible for instructing the Owner's operating staff, in the presence of the Architect/Engineer's representative, in the proper operation and maintenance of the mechanical systems and equipment. Include a statement signed by the Owner that instructions have been given for proper operation and maintenance of the mechanical systems and equipment.

1.13 GUARANTEES

- A. Furnish a written guarantee, to the Architect/Engineer, that will make the contractor responsible at his own expense for any imperfections in material and/or workmanship which may develop under ordinary use within a period of one (1) year from final Owner's acceptance of the work.
- B. Furnish all written guarantees from equipment and/or material manufacturers which shall include the operating and performance conditions and capabilities upon which they are based.
- C. Permanent equipment that is used for temporary heat or cooling shall be guaranteed for one (1) year from the date of final acceptance of the project.

1.14 PORTABLE AND DETACHABLE PARTS

- A. Retain all portable and detachable parts of installation such as keys, spare accessories, operating manuals, etc. include in the Operation and Maintenance Manual.

1.15 OPERATION AND MAINTENANCE MANUALS

- A. Furnish to the Architect/Engineer two (2) copies of an approved bound (3 ring binder) book with tabs for sections covering each item of equipment. These notebooks shall include shop drawings, maintenance manuals, operating manuals and parts lists to instruct the Owner on proper operation and use as well as maintenance for each piece of equipment. These books shall also include contractors', subcontractors' and manufacturers' names, telephone numbers and addresses.
- B. Manuals shall also include sequence of operation, control equipment literature, wiring and control diagrams, certificates of guarantees, certificates of inspection, mechanical system test and balancing reports. The contractor shall accumulate and summarize the control and maintenance sequence in a typewritten sheet to be included in the report.
- C. The manuals must be approved by the Architect/Engineer before final payment to the contractor. The Engineer reserves the right to request and be furnished any additional information that he deems necessary to be included in the manuals.

1.16 RESPONSIBILITIES FOR USE OF SUBSTITUTE MATERIALS

- A. Contractor shall notify Architect/Engineer in writing at least ten (10) calendar days before bids are due for approval to use materials and/or equipment other than that which has been specified or scheduled. If substitute materials and/or equipment are approved and used, it will be this contractor's responsibility to guarantee that the items will function as the specified equipment or materials, will in no way alter the design of the structure or system, and will not require any additional mechanical work such as piping, ductwork, etc. Any additional cost required by substitute materials will be the responsibility of the contractor.
- B. It will be the contractor's responsibility, at his own expense, to remove or replace any non-approved equipment or material or any approved equipment or materials not originally specified or scheduled if equipment and materials do not meet with the satisfaction of the Architect/Engineer.
- C. It shall be the Fire Protection Contractor's responsibility to coordinate and pay for any Electrical Contractor costs due to any changes in substitute materials and/or equipment's power requirements, which differ from that shown on the design documents.
- D. No consideration will be given to requests for substitute materials because of delivery problems unless the contractor can prove that orders were placed as soon as possible after contract was awarded and that delays were not caused by submittal of unscheduled or unspecified (substituted) materials to the Architect/Engineer.

1.17 COST BREAKDOWN AND EQUIPMENT LIST

- A. The successful bidder shall be responsible for submitting a cost breakdown to the Architect/Engineer and Owner within ten (10) calendar days after date of request of the breakdown. During progress of the work, if changes occur which cause

additional cost, the price on such items shall be broken down in accordance with the items listed in the breakdown.

- B. The bidders shall be responsible for submitting a complete list of all equipment manufacturers, makes, models, etc. that will be used for this project with their proposal. The equipment list shall be typed on the contractor's letterhead and shall be signed by the authorized officer.

1.18 MATERIALS AND EQUIPMENT

- A. Materials and equipment furnished under this project shall have a minimum warrantee of one (1) year. All materials and equipment shall be new, of first class quality and shall be furnished, delivered, erected, installed and finished in every detail and shall be so selected and arranged as to fit into the building space. All material or equipment that is not specified but necessary for this project shall be subject to the approval of the Architect/Engineer.
- B. The contractor shall be required to remove and replace at his/her expense any non-approved materials or equipment installed by him as directed by the Architect/Engineer.
- C. Any materials or equipment not specified or scheduled but similar to that which has had prior approval shall be listed as a substitution and noted on the proposal form as such.
- D. The contractor shall include all miscellaneous materials and labor required to completely install and operate the mechanical systems as is intended by these drawings and specification.

1.19 SCHEDULE, COORDINATION AND INSTALLATION OF WORK

- A. The contractor shall carry on work in such a manner as to meet the dates as scheduled by the General Contractor and shall work overtime at no expense to the Owner as required to comply with this schedule. This contractor shall schedule all work with Owner and Architect/Engineer and schedule shut down of systems with Owner.
- B. Examine the site and all drawings and specifications and coordinate work with all other trades before commencing work for this project. Arrange work essentially as shown with the exact layout to be made on the job to suit actual conditions. Precise locations of equipment and materials shall be coordinated and shall be the responsibility of this contractor. Should any conflicts in location occur, and necessary deviations from drawings are required as determined by the Architect/Engineer, the contractor shall make necessary adjustments without additional cost to the Owner.
- C. Drawings are diagrammatic with no attempt made to show and precisely locate every tee, ell, fitting, valve, etc. All equipment, piping, ductwork, etc. shall be located and/or routed to allow for the most convenient access for servicing.

- D. Arrange for necessary access doors, panels, etc. to allow servicing of equipment, piping, valves, fire dampers, etc. Perform any cutting and patching as required, made necessary by failure to make proper arrangements.
- E. Indicated equipment connections, sizes and locations shall be verified and connected according to manufacturer's shop drawings and installation instructions. Thoroughly investigate the space provided for equipment and connections before ordering equipment. All equipment shall be selected to fit into the space allowed, including connections with adequate space allowed for operation and maintenance.
- F. All work shall be installed in a neat and workmanlike manner, using skilled personnel thoroughly qualified in the trade or duties that they are to perform. Rough work will be rejected.
- G. Coordinate all equipment deliveries and schedules to allow timely installation. Contractor shall separate equipment into sections and reassemble in building if required by the installation at no extra cost to the Owner.
- H. Furnish a superintendent approved by the Architect/Engineer to oversee and coordinate the work to be performed with all other trades.
- I. Coordinate location of pipes, sprinkler heads, etc. with other building components such as structural components (beams, joists, columns, etc.), electrical components (lighting, conduits, etc.) and architectural components (walls, ceilings, floors, pipe chases, roof, etc.).
- J. Before starting work, Contractor shall verify that available space for proposed pipes, ducts, equipment etc. is adequate for the intended purpose and will result in a first class installation. Irregardless of drawings, responsibility for first class operating systems rests with the Contractor.
- K. Arrange for chases, slots, openings, etc. and other building components to allow for mechanical systems installation. Coordinate cutting and patching of these components to accommodate installation. This contractor shall be responsible for accurately locating for the general trades all chases, shafts, etc. and shall be responsible for all cutting and patching if these chases were not accurate or not coordinated in time with the general trades. Coordinate installation of all sleeves in walls, on floors or other structural or architectural components.
- L. Sequence, coordinate and integrate installation of equipment and materials for efficient work flow during the project. Particular attention should be spent on larger pieces of equipment.
- M. Install equipment and materials with provisions for necessary access for service and maintenance. Allow space for removal of all parts that may require replacement or servicing.
- N. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- O. Coordinate requirements for access panels and doors for fire protection items requiring access that are concealed behind finished surfaces with the General Trades. Access panels and doors are to be furnished and installed by the Architectural Trades unless otherwise noted. When access panels are required, valves and equipment components requiring access shall be located to minimize the number of panels.
- P. Examine the work as it progresses and alert the Architect/Engineer in writing of any instances or obstructions that will prevent this contractor from performing his/her work.

1.20 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. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.21 PLACEMENT OF ORDERS

- A. No consideration will be given to requests for substitute materials because of delivery problems unless the contractor can prove that orders were placed as soon as possible after contract was awarded and that delays were not caused by submittal of unscheduled or unspecified (substituted) materials to the Architect/Engineer.

1.22 COOPERATION WITH ARCHITECT/ENGINEER AND OTHERS

- A. Coordinate all aspects of the fire protection system installation with all other trades, existing conditions, etc.
- B. If the bidder believes that changes in design are required to meet intended design capacities and operation or material and/or equipment is obviously omitted from these specifications and drawings, the bidder shall contact the Architect/Engineer in writing at least ten (10) days before bid date. The acceptance of a bid by the Owner shall be binding and shall indicate that the bidder does not require any changes in design nor additional costs in order to meet the design and performance of the mechanical system as indicated in these specifications and drawings.
- C. Examine the work as it progresses and alert the Architect/Engineer in writing of any instances or obstructions that will prevent this contractor from performing his/her work.

1.23 WORK INVOLVING OTHER TRADES

- A. Equipment or materials specified may have to be installed by other trades (such as electrical trades or architectural trades) due to code requirements or union jurisdictional requirements. Where this occurs, this contractor shall include all costs required by other trades to complete the work and hire the respective trade to perform this work.

1.24 PERFORMANCE DATA AND ACCESSIBILITY

- A. All performance data specified in this specification or scheduled on drawings shall be considered actual performance of the equipment after installation. The supplier and installer shall be responsible for suitable allowances to adjust equipment to design capacities when actual operating and installation conditions differ from drawings.
- B. All equipment and materials shall be installed to allow access for servicing and maintenance. Coordinate final location of such equipment and materials that are concealed with required access doors on panels. Allow ample space for replacement or servicing. Extend all grease fittings to an accessible location.

1.25 CUTTING AND PATCHING

- A. Unless noted otherwise, the Mechanical Trades shall be responsible for all cutting, patching and associated work required. This work shall be performed by trades normally performing this type of work except drilling of holes shall be done by the contractor requiring same. This includes replacing areas of cutting required by this work with proper reinforcing, termite shielding, materials, finishing, etc. to restore the areas to their original condition, and filling all openings around ducts, piping, etc. with approved fire retardant materials. Irregardless, all drilling of holes shall be the responsibility of the Contractor requiring same.
- B. If noted on drawings that the General Trades will be responsible for all cutting and patching, it will be the Mechanical Trades responsibility to notify all General Trades during bidding of all areas requiring cutting and patching. Irregardless, all drilling of holes shall be the responsibility of the contractor requiring same.

1.26 WORK IN EXISTING BUILDINGS

- A. Coordinate and schedule all work in existing building with Owner and Architect/Engineer. Systems shall be kept in operation at all times if at all possible. If a system shut-down is required, the contractor shall schedule with the Owner, the time and length of shut-down. A system shall not be shut down without written permission from the Owner.
- B. All existing fire protection equipment, piping, etc. that is to be removed shall remain the property of the Owner. The contractor shall remove and locate this material that remains the property of the Owner to a location determined by the Owner somewhere on site. If the Owner does not want to maintain possession of the removed material, the contractor shall be responsible for removing material from the site and disposing of this material as necessary to meet all codes and re

quirements and shall pay all costs as required for any disposal fees, inspections, permits, etc.

- C. All existing fire protection piping, equipment, etc. whether shown on drawings or not that is to be removed and/or abandoned and does not remain property of the Owner shall be removed from site.
- D. Any existing fire protection piping, valves, equipment, etc. serving the existing building which are shown or not shown on drawings and are required for systems operation shall remain in use. If these systems require relocation to allow installation of new systems, the contractor shall be responsible for relocating to an Owner and Architect/Engineer approved location. The contractor shall pay all cost for this work and include such cost in his/her bid. (As specified previously, contractor shall be responsible for examining site and include all cost for work required to complete this project.)
- E. When active services, etc. are encountered in this project, the contractor shall furnish and install bracing, support, etc. as required to protect and keep these services active. (As specified previously, these drawings are diagrammatical. The contractor shall be responsible for verification of all existing services, piping, equipment, etc.).

1.27 EQUIPMENT GUARDS

- A. All rotating or moving parts of equipment that are located so as to be a hazard shall be fully enclosed or properly guarded as to meet or exceed all regulations and OSHA requirements.

1.28 ELECTRICAL CONNECTIONS

- A. The Electrical Trades shall be responsible for furnishing and installing all electrical equipment, wiring, etc. required for operation of the fire protection equipment unless otherwise noted on the drawings. The Fire Protection Contractor shall furnish detailed information and wiring diagrams to the Electrical Trades for all equipment specified and/or scheduled for this project. In the event that the Fire Protection Contractor furnishes an "approved equal" or "alternate" that require changes in the original electrical design, the Fire Protection Contractor shall pay all costs to the Electrical Trades as required to make satisfactory adjustments. All electrical work shall be done in accordance with the latest edition of the National Electric Code.

1.29 MOTORS, MOTOR STARTERS AND DISCONNECTS

- A. Unless otherwise noted on drawings, motors shall be of constant speed 1750 rpm, new NEMA Design B, 40°C rise, horse power rated, open drip-proof except TEFC in dirty atmosphere, induction type motor with service factor of 1.15 and be of sufficient capacity to continuously operate the apparatus to which it is connected under all conditions of operation without exceeding nameplate ratings.
- B. Motors shall be premium efficiency as calculated using IEEE test method 112B.

- C. Motors $\frac{1}{2}$ Hp. or larger shall be three phase; motors under $\frac{1}{2}$ Hp. shall be 115 volt, 60 cycle, single phase. Before ordering the motors, the contractor shall verify correct motor voltage with the Electrical Trades and field conditions.
- D. The Mechanical Trades shall furnish, for equipment under Division 21, all special switches, disconnects, starters, alternators, etc. as specified or scheduled to be factory furnished and/or factory installed with the equipment including wiring diagrams, etc. whether it is to be factory installed or field wired. All other motor starters, disconnects, etc. not noted as factory furnished shall be furnished and installed by the Electrical Trades as specified in Division 26 - Electrical.
- E. Starters that are to be factory furnished with equipment shall be of the combination type and shall be as specified under Division 26 - Electrical Trades Division. Furnish overload protection for each phase.
- F. All wiring methods and materials shall meet NEMA, National Electric Code and State of Michigan Code requirements.
- G. All displays on control panels shall be on face of the panels.
- H. Motors having V-belt shall be furnished with base slide rails or other form of adjustment.

1.30 LUBRICATION AND MAINTENANCE

- A. Contractor shall maintain, oil, lubricate, etc. all equipment furnished under Division 21 until final acceptance by the Owner. Protect all bearings and shafts during installation and thoroughly grease the steel shafts to prevent corrosion. The contractor shall be responsible for any and all damage to bearings, shaft, etc. of Division 21 equipment operated or not until final acceptance by the Owner.

1.31 EXCAVATION AND BACKFILLING

- A. Furnish all excavation, backfilling and removal of excess dirt to accomplish installation of the fire protection system unless otherwise noted on drawings.
- B. All excavation shall be by open cut from the surface. Contractor shall determine whether excavation shall be by machine or by hand except where existing utilities may be located where excavation shall be by hand. Contractor shall be responsible for all damage to existing facilities and services. Excavation shall be to a depth of at least 6" to allow granular bedding below pipe or duct.
- C. If for any reason the work is suspended, the contractor shall properly protect the excavation and leave the areas unobstructed.
- D. Trench width shall allow sufficient width at centerline of pipe to allow at all times a first class construction/installation method but in no case should be less than 12" larger than the nominal pipe or duct size. This shall especially be true in areas that joints must be connected. Joint holes may have to be made with overhanging sides to make installation safe for workmen.

- E. The excavation shall be at all times finished and backfilled to the required grade after completion and approval of work. Not more than 100 feet of trench shall be excavated and open unless written approval is given by the Architect/Engineer.
- F. The subgrade shall be 4" to 6" below the pipe of granular bedding graded and tamped by hand or mechanical means to the exact elevation required at the bottom of the pipe. Granular materials shall be approved fine aggregate meeting MDOT #2NS specifications. This material shall pass a ½" sieve but will be retained on a #4 sieve. If poor soil conditions exist which will not give proper support to the pipe, duct or structure, furnish granular fill as required to remedy this situation and give proper support.
- G. Furnish and install properly sloped sheet piled, shored and braced in areas that the soil requires this to maintain a proper excavation and prevent any movement of earth which could in any way damage the work under construction. When removing the sheeting and bracing, special care should be taken to prevent any caving of the sides of the excavation and injury to the completed work or adjacent property.
- H. Take all necessary action to keep trenches and other excavation areas free from water at all times. Use such methods as pumping, ditching, well pointing, etc. to prevent water in trench or excavation. Dewatering of trench shall have constant supervision.
- I. Backfill excavation and trenches with approved granular material around sides of pipe and at least 12 inches above the top of the pipe laid not more than in 6 inch layers that are thoroughly tamped to 95% of its maximum density. There shall be no backfilling by any mechanical means until the granular material has been firmly tamped around the entire pipe to 12 inches above the pipe. All material used for backfilling shall be approved by the Architect/Engineer. Wherever trenching crosses walks or roadways or isolated inside of building, backfill top 6'-0" of trench with sand or bank run gravel in layers not to exceed 6 inches in depth and carefully compact by hand or machine. Do not backfill with frozen materials.
- J. No piping shall be covered until it has been tested, inspected and approved. Upon completion of backfilling, grade shall be restored in indicated elevation and left in reasonable condition for finish grade by others unless otherwise noted on drawings.
- K. Before final acceptance of work, all disturbed streets, drives, curbs, walks, parking areas, etc. shall be paved, graveled or other to as near their original condition as possible. All unused excavated material shall be removed from site if directed by the Architect/Engineer.

1.32 BASES AND SUPPORTS

- A. This contractor shall be responsible for furnishing all equipment pads and supports for the fire protection equipment and materials, unless otherwise noted on drawings.
- B. All floor mounted fire protection equipment shall have a reinforced concrete pad furnished unless otherwise noted on drawings. The concrete pads shall be tied to

the building floor with expansion bolts located maximum of 4'-0" on centers with a minimum of four (4) bolts, set before pouring and concealed within the pad. The Mechanical Trades shall verify exact pad or support size with the equipment manufacturer and shall size pad with adequate area to allow sufficient room for installation of vibration isolators, equipment mounting hardware, etc. Concrete pads shall have a 45 degree bevel at the top edge. The contractor shall verify exact location of concrete pads.

- C. Furnish all steel, hanging material, rods, etc. for suspending equipment off floor unless otherwise noted on drawings for equipment to be furnished under Division 21. This includes all structural steel for supporting between beams.
- D. All support structure shall be of strength to safely withstand all stresses and loads to which they will be subjected and shall distribute load properly over the building area. Supports shall be designed to avoid undue strain to equipment and to avoid interference with piping, pipe connections, service and maintenance clearances, etc.
- E. Where equipment is to be floor mounted and requires legs, this contractor shall furnish and install structural steel members or steel pipe and fittings for legs. Fasten and brace to equipment and furnish flange at base to allow bolting to floor.
- F. Where equipment is to be ceiling or wall mounted, furnish necessary platform, structural steel, hardware, etc. as is most suitable for support of this equipment.
- G. All supports shall be approved by the Architect/Engineer.
- H. All piping shall be suspended from structural steel members utilizing rods and approved hanger devices. Do not use metal deck for support. Beam clamps such as the Grinnell Fig. 260 or approved equal shall be used. Sheet metal "straps" shall not be used in place of rods.

1.33 SLEEVES, PLATES AND COLLARS

- A. Furnish all sleeves, plates and collars for piping, ductwork, etc. passing through walls, floor ceilings, foundations, etc. Coordinate with the General Contractor the exact location and size of required openings. No pipe or duct shall pass through a wall, floor ceiling, etc. without a sleeve. This contractor shall be responsible for sleeve locations and securing sleeves before concrete is formed.
- B. Sleeves for steel pipe shall be standard weight black steel pipe. For walls, foundations and ceilings, sleeve shall be kept flush with finished surfaces. For floors, the sleeve shall be set flush with bottom of concrete construction and be extended up 1/4" above concrete floor. Sleeves shall be set in place before construction of walls, floors, ceilings, etc.
- C. Sleeves for copper pipe shall be type "M" hard copper tubing installed typical to that of steel pipe sleeves.

- D. Sleeves for piping shall be sized to allow insulation to run continuous through sleeve whenever possible and to allow not less than 1/4" all around bare pipe or insulation.
- E. All penetration voids shall be sealed smoke tight with non-combustible materials similar to 3M or Hilti firestop systems to maintain the integrity of the fire rated structure.
- F. Where bare piping 2" and smaller pass through wall or floors, furnish polished chrome plated brass escutcheons, split type. Bare piping 2 1/2" and larger that pass through walls or floor, furnish 22 gauge galvanized steel metal collars so as to cover opening.

1.34 RIGGING AND HOISTING

- A. Perform all required rigging, hoisting, transportation, moving, etc. of all equipment, materials, etc. to be furnished and/or installed under Division 21 whether furnished by this contractor or by the Owner or other trades.

1.35 STORAGE FACILITY

- A. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.36 PROTECTION FROM DAMAGE

- A. The contractor shall be responsible for all materials, equipment, etc. and all work installed by himself and shall protect it from damage until final acceptance of this project by the Owner.
- B. Furnish all coverings and protection from dirt, dust, rain, storm, heat, traffic, wear, etc. and all possible injury including that by other workmen. Any equipment, workmanship, materials, etc. damaged prior to final acceptance by the Owner of this project shall be properly repaired at no expense to the Owner.
- C. Protect all equipment, materials, etc. from freezing.

1.37 COMMON PIPE MATERIALS AND INSTALLATION INSTRUCTIONS

- A. Refer to individual 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. Refer to individual piping Sections for special joining materials not listed below.
 - 1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

- a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- b. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
5. 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.
6. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
7. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

1.38 PIPE HANGERS AND SUPPORTS

- A. Hangers and saddles shall be Modern Hanger Corp., Grinnel/Elcen, Autogrip, or M-CO. Inserts shall be of the type to receive a machine bolt head or nut after installation, permit horizontal adjustment, and shall be flush with the surface. For copper pipe with steel hangers, clean and wrap pipe with two layers of plastic insulating tape at point of contact. Roller supports shall be adjustable type with insulated standoff. Rods shall be used for suspended installation. Sheet metal "straps" shall not be used in place of rods.
- B. Hangers for piping with vapor barrier sealed insulation shall be multipurpose pipe saddles fitting over the insulation. Wire or perforated strap iron will not be permitted for pipe supports. Do not support hangers from roof deck. Furnish and install all support steel as required to suspend from structural steel joist or beams. Hangers shall be clevis or split ring type with vertical adjustment and beam clamp similar to Grinnell Fig. 260, with maximum spacing per ASHRAE or NFPA Standards, whichever is most stringent:

Pipe Size	Steel Pipe	Copper Pipe	PVC Pipe	Rod Size
½ to ¾ inch	5 foot	5 foot	Continuous	3/8"
1 to 1¼ inch	7 foot	6 foot	Continuous	3/8"

1½ to 2 inch	9 foot	8 foot	Continuous	1/2"
2½ to 3½ inch	11 foot	9 foot	Continuous	5/8"
4 to 6 inch	12 foot	10 foot	Continuous	3/4"
8 to 12 inch	12 foot	--	Continuous	7/8"
14 to 18 inch	12 foot	--	Continuous	1¼"

- C. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
- D. Hangers for Pipe Sizes ½ to 1½ Inch: Malleable iron, adjustable swivel, split ring.
- E. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Wall Support for Pipe Sizes up thru 3 Inches: Cast iron hook.
- H. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- I. Vertical Support: Steel riser unistrut clamps at high, mid, and low locations.
- J. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- L. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustments, top slot for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

1.39 PIPING AND EQUIPMENT SUPPORT

- A. Attachments of mechanical equipment to structural members are the responsibility of the installing trade. Structural members shall not be field cut, welded or otherwise modified without approval of the Architect/Engineer. Attachment to steel joist shall be made at panel points. When routing piping or ductwork perpendicular to joist, a support shall be provided at every steel joist; when parallel to joist, a support shall be provided at no more than 6' on centers or two panel bays. Structural members shall not be overloaded as a result of attachments. Attachment/equipment loading for all trades resulting in total load greater than an equivalent uniform 5 psf for any member shall be submitted to the Architect/Engineer for review. Mechanical Trades may contact the project Structural Engineer as required for panel point location assistance and welder certification requirements. Electrical Trades are still responsible for design, layout, and fabrication and installation of electrical supports and support attachment methods. Mechanical Trades shall submit attachment methods to the Structural Engineer for review.
- B. Install products in accordance with manufacturer's instructions.

- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut structural members without permission from Architect/Engineer.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

1.40 CLEANING AND FINISHING

- A. During construction period, remove all debris, rubbish, tools, equipment, unused materials, etc. as required or requested by the Architect/Engineer. All cost for cleanup and removal will be the responsibility of the contractor.
- B. Upon completion of the project and before final acceptance by the Owner, the entire installation shall be thoroughly cleaned, all rubbish and unused material removed to the satisfaction of the Architect/Engineer. All dust and dirt shall be removed from all equipment, piping, ductwork, etc.
- C. Thoroughly clean all heating units, fans and fan wheels, diffusers and grilles, air handler plenums and air filter frames, etc. using compressed air if necessary.
- D. Thoroughly clean all floor drains, cleanouts, and plumbing fixtures. Clean all trays and strainers.
- E. Finish paint all equipment, materials, piping, etc. as noted on drawings or listed in this specification. Match Owner's existing color scheme. Any Division 21 equipment which has been scratched or damaged shall be finished equal to the original finish.

1.41 EQUIPMENT/SYSTEMS START-UP

- A. Furnish and schedule manufacturer's start-up service for all equipment and systems. These start-up services shall be performed in the presence of, and to the satisfaction of the Owner and Architect/Engineer.

1.42 EQUIPMENT/SYSTEMS SIGN-OFF

- A. The Mechanical Trades shall furnish written sign-offs on all systems stating that the equipment and systems have been checked, tested, started and that their operation has been verified correct through the entire range of operation that can be expected through the seasons.

1.43 SUBSTANTIAL COMPLETION

- A. Contractor shall submit a letter to the Architect/Engineer advising that all work has been completed in accordance with plans and specifications and the project is ready for a final walk-thru.

END OF SECTION

MAI: 2024-2701

SECTION 21 05 10

FIRE PROTECTION SYSTEMS TESTING, CLEANING & STARTUP

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing of piping systems.
- B. Cleaning of piping systems.
- C. Substantial completion check list and sign-off forms.

1.2 SCOPE OF WORK

- A. The work covered by this specification consists of furnishing all labor, equipment, material, chemicals or methods that are mentioned, listed or scheduled on drawings or are in this specification. This includes all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the cleaning, flushing and testing of the fire protection piping systems for this project. The work covered under this section of the specification is in no way complete within itself, but is supplementary to the entire specification and drawings.
- B. The substantial completion forms shall be required to be signed and submitted to the Architect/Engineer for approval prior to any insulation of piping systems or installation of ceiling tiles. The person that signs the substantial completion forms shall witness the testing, flushing and chemical treatment of the systems. The signature person's company shall be responsible for all cost incurred with future work by the Architect/Engineer or Owner due to inadequate testing, cleaning, operation or chemical treatment of the piping systems.

1.3 SUBMITTALS

- A. Submit electronic copies of the completed and signed substantial completion forms included in this section. Submit to the Architect/Engineer as system flushing, testing, and chemical treatment occurs. The Mechanical Trade shall maintain one set of substantial completion forms and submit them to the Architect/Engineer prior to the Architect/Engineer final project walk-through.
- B. Submit electronic copies of all equipment, chemicals and product data being furnished to this project for approval.
- C. Submit electronic copies of manufacturer's installation instructions, including placement of equipment in systems, piping configuration, and connection requirements.
- D. Submit certificate of compliance from authority having jurisdiction, indicating approval of systems that require review by local and state authorities.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for public sewage systems.
- B. Products requiring electrical connection and listed and classified by UL as suitable for the purpose specified and indicated.

PART 2 PRODUCTS – Not Applicable

PART 3 - EXECUTION

3.1 FIRE PROTECTION PIPING SYSTEM

- A. All fire protection piping, sprinkler heads, fire pump, etc. shall be flushed, tested, and started per all NFPA and NEC requirements.

3.2 SYSTEM COMPLETION CHECKLIST

- A. The checklist which follows this specification section is to be considered part of the specifications.
- B. The checklist is to be completed by the Installing Contractor and the prime Mechanical Contractor for each item as directed.

END OF SECTION

MAI: 2024-2701

Hunger Solution Center,
Saginaw, Michigan.

SYSTEMS COMPLETION CHECKLIST						
Inspection/Review Item	Notice Required	Installing Contractor		Date	Owner's Representative Signature	Remarks
		Name	Signature			
Fire Protection System, Continued						
Owner's Training	7 days	Owner Representative				Complete Owner's training or operation of the automation system.
Flushing and testing of fire protection piping	48 hours	Owner Representative				Tested per NFPA requirements
Start-up and testing of fire pump and jockey pump system	48 hours	Owner Representative				Start-up, flow test, etc. per NFPA requirements

By signing this form, the Contractor is certifying that he has personally witnessed completion of that item, and it is complete and complies with all respects to the drawings and specifications.

All items are to be signed off on and submitted to MacMillan Associates Inc. before a final project walk-thru by the Engineer is requested. If the Engineer discovers items incomplete and/or not in accordance with this checklist, the drawings, or the specifications, the Contractor will be backcharged for the Engineer's time and expenses.

SECTION 21 10 00

FIRE PROTECTION PIPING, SPRINKLER HEADS, & MISC.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pipe, fittings, valves, and connections for a complete fire protection system including all required sprinkler heads, piping, standpipes, etc.
- B. Wet-pipe sprinkler system.
- C. Dry-pipe sprinkler system (when required).
- D. Double interlock preaction system (when required).
- E. System design, installation, and certification.
- F. Fire department connections.

1.2 REFERENCES

- A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
- B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
- C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
- D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
- E. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
- F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded.
- G. ANSI/ASME B16.25 - Buttwelding Ends.
- H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
- I. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
- J. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
- K. ANSI/ASTM A47 - Malleable Iron Castings.
- L. ANSI/ASTM B32 - Solder Metal.
- M. ANSI/AWS A5.8 - Brazing Filler Metal.

- N. ANSI/AWWA C104 - Cement Mortar Lining for Ductile Iron Pipe.
- O. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Pipe.
- P. ANSI/AWWA C111 - Rubber Gasket Joints for Ductile Iron Pipe.
- Q. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
- R. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
- S. ANSI/AWWA C500 - Gate Valves, 3" thru 48" for water and sewage systems.
- T. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.
- U. ANSI/AWWA C509- Resilient Seated Gate Valves 3" thru 12" for water and sewage systems.
- V. ANSI/AWWA C600 - Installation of Ductile Iron Water Mains and Appurtenances.
- W. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- X. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- Y. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- Z. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- AA. NFPA 13 - Installation of Sprinkler Systems.
- BB. NFPA 14 - Standpipe and Hose Systems.
- CC. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.
- DD. NFPA 70 - National Electrical Code
- EE. UL - Fire Protection Equipment Directory.

1.3 AUTOCAD BACKGROUND FILES

- A. The Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$100.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Contractor.

PART 2 PRODUCTS

2.1 SPRINKLER AND STANDPIPE PIPING, BURIED (Must be Approved by Governing Authorities)

- A. Ductile Iron Pipe: ANSI/AWWA C151/A21.51 rated 350 psi. with Class 350 fittings.
1. ANSI thickness Class 50 minimum, nominal pipe wall thickness .27" minimum, rated 350 psi at laying condition Type 1.
 2. Cement lined as per AWWA C104 (ANSI A21.4)
 3. Pipe Joints: Push on, ANSI/AWWA C1533/A21.53, with Tyton gaskets.
 4. Fitting Joints: Mechanical, compact, ANSI/AWWA C153/A21.53 with stainless steel or Corten anti-rotation bolts and sacrificial zinc anode cap on each bolt.
 5. Coating: Exterior of pipe and fittings, asphaltic coating as per ANSI/AWWA.
 6. Polyethylene encasement as per ANSI/AWWA C105/A21.5.
 7. Concrete thrust blocks, installation, etc. as per published engineering and construction standards of Michigan Department of Transportation and local codes.
 8. All material and installation shall be in accordance with manufacturer's recommendations.
- B. PVC Pipe:
1. 1½" to 3" - ASTM D2241, SDR 21 - Class 200 AWWA C900.
 2. 4" and Larger - ASTM D2241, DR18- Class 150 AWWA C900.
 3. Fittings: ASTM D2466, PVC
 4. Joints: ASTM D3139, integral bell and gasket seal installed with concrete thrust blocks, or ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 SPRINKLER AND STANDPIPE PIPING, ABOVE GROUND

- A. Fire protection pipe shall be black steel, ASTM A135, ASA Schedule 10 for grooved systems, Schedule 40 for screwed systems, Grade A, ASTM Spec. A-53, U.L. listed and F.M. approved and in compliance with NFPA 13.
1. Fittings for steel pipe may be grooved with gasket and clamp, threaded, flanged, or welded. Welding shall be performed by ASME (Boiler Code - Section IX) qualification welders. Fittings shall be 175 psig water working pressure.
 2. Grooved end fittings shall be short-pattern, with flow equal to standard pattern fittings. Basis of Design: Victaulic FireLock.
 3. Grooved joint couplings shall consist of two ductile iron housing segments to ASTM A536, pressure responsive gasket to ASTM D2000, and zinc electroplated steel bolts and nuts to ASTM A449.
 - a. Rigid Type: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. Tongue-and-recess type couplings, or any coupling that

requires exact gapping of bolt pads at required torque ratings, are not permitted.

- 1) Victaulic Style 009-EZ and 107H, Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket, suitable for water service to +250 deg F
 - 2) Victaulic FireLock Style 005 and Style 07 "Zero-Flex"
- b. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors. Victaulic Installation-Ready Style 177 or Style 77

2.3 GATE VALVES

- A. Up to and including 2 Inches: Bronze body, bronze trim, rising stem, handwheel, OS&Y, single wedge or disc, threaded ends.
- B. Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged or grooved ends. Basis of Design: Victaulic Series 771H.

2.4 BUTTERFLY VALVES

- A. 2 Inches and Over: Ductile iron body with grooved ends, electroless-nickel coated ductile iron disc, pressure responsive elastomer seat, and stainless steel stem. (Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating.)
- B. Valves shall include a weatherproof actuator housing with two SPDT supervisory switches, and handwheel.
- C. Basis of Design: Victaulic Series 705.

2.5 DRAIN VALVES

- A. Gate Valve.
- B. Brass ball valve with cap and chain, 3/4 inch hose thread.

2.6 STANDPIPE AND HOSE SYSTEM EQUIPMENT (When required)

- A. Hose Cabinet:
 1. Style: Recessed, semi-recessed or surface mounted. See drawings.
 2. Tub: 16 gage thick steel, prepared for pipe and accessory rough-in.
 3. Door: 12 gage thick steel, with 1/4 inch thick wired glass full panel, hinged, positive latch device.
 4. Finish: Enameled, color red.
- B. Hose Rack: Steel; with polished chrome finish; swivel type with pins and water stop.
- C. Hose: 50 feet of rubber lined synthetic hose; mildew and rot-resistant.

- D. Nozzle: Brass, chrome plated; combination fog, straight stream, and adjustable shut-off.
- E. Angle Valve: Hydrolator type, 1½ inch nominal size. Verify size with NFPA requirements.
- F. Fire Department Outlet Valve: Angle type; brass finish; 2½ inch size, thread to match fire department hardware, 300 psig working pressure, with threaded cap and chain of same material and finish.

2.7 FIRE DEPARTMENT CONNECTION

- A. Type: Flush mounted wall type with brass. Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
- B. Drain: ¾ inch automatic drip, outside.
- C. Label: "Standpipe - Fire Department Connection".
- D. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing. Basis of Design: Victaulic #10-DR.

2.8 SPRINKLER HEADS

- A. Sprinklers shall be glass bulb type, with a hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation. Basis of Design: Victaulic Company.
 - 1. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss.
 - 2. Sprinklers with rubber O-rings are not permitted.
- B. Suspended Ceiling:
 - 1. Type: Standard coverage semi-recessed pendant type with matching push-on escutcheon plate. (Used in finish areas unless noted otherwise on drawings).
 - 2. Head Finish: Chrome plated.
 - 3. Escutcheon Plate Finish: Chrome plated.
 - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 - 5. Basis of Design: Victaulic Model V27.
- C. Exposed Area Type:
 - 1. Type: Standard coverage upright type.
 - 2. Head Finish: Brass.
 - 3. Fusible Link: Glass bulb or fusible solder link type temperature rated for specific area hazard.
 - 4. Basis of Design: Victaulic Model V27.
- D. Sidewall Type:

1. Type: Standard coverage semi-recessed horizontal sidewall type with matching push on escutcheon plate and guard if required by area use.
 2. Head Finish: Chrome plated.
 3. Escutcheon Plate Finish: Chrome plated.
 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
 5. Basis of Design: Victaulic Model V27.
- E. Concealed type (use only when noted on drawings):
1. Quick response bulb spring type, 175 psi working pressure rated, 500 psi factory tested, bronze frame, brass deflection, brass screw, engineered plastic bulb seat, silicone O-ring, glass bulb with glycerin solution, upper steel escutcheon plate, brass cover plate with color selected by Architect.
 2. Glass bulb shall be temperature rated for specific hazard.
 3. Basis of Design: Victaulic Model V38 or V39.
- F. Security Areas/Holding Cells
1. Utilize institutional maximum security sprinkler heads in all prisoner holding and transport areas that meet all NFPA and Department of Correction codes requirements and recommendations.
- G. Guards: Finish to match sprinkler head.
- H. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.
- I. Vic-flex multiple-use, open-gate, flexible drop system may be used to properly locate the sprinklers. The drop shall include a UL approved Series AH2 braided hose with a bend radius to 2" to allow for proper installation in confined spaces. The hose shall be listed for [(4) bends at 31" length] [(5) bends at 36" length] [(8) bends at 48" length] [(10) bends at 60" length] [(12) bends at 72" length]. Union joints shall be provided for ease of installation. The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 bracket. The bracket shall allow installation before the ceiling tile is in place. The drop system shall include all required supports and bracing. The braided drop system is UL listed and FM approved for sprinkler services to 175 psi (1206 kPa).

2.9 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate electrically operated alarms, with pressure retard chamber and variable pressure trim. Internal components shall be replaceable without removing the valve from the installed position. Basis of Design: Victaulic Series 751.
- B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, EPDM clapper seal or rubber faced clapper to automatically actuate electrically or hydraulically operated alarms, with accelerator. Actuation to be determined by Fire Protection Contractor to meet all codes and regulations. Required air pressure shall be 13-psi (90-kPa). The valve shall be externally resettable, and all internal components shall be replaceable without removing the valve from the installed position. Basis of Design: Victaulic Series 768-NXT.

- C. Flooding Deluge Valve: Check type with an aluminum bronze clapper and EPDM clapper seal, or gate type valve with rubber disc actuated manually, pneumatically, electrically or hydraulically with electrically or hydraulically operated alarms, with alarm testing trim. Type of actuation to be determined by Fire Protection Contractor to meet all codes and requirements. The valve shall be externally resettable, and all internal components shall be replaceable without removing the valve from the installed position. Basis of Design: Victaulic Series 769-NXT.
 - D. Preaction Valve: Deluge valve and swing check valve with releasing trim featuring both a solenoid valve and a dry pipe actuator in a series configuration. The swing check valve isolates the body of the deluge valve from the system air pressure, which holds the dry pipe actuator closed. The solenoid valve remains closed until it is electrically energized by a deluge releasing panel that responds to the operation of a fire detection device. The valve shall be externally resettable, and all internal components shall be replaceable without removing the valve from the installed position. Basis of Design: Victaulic Series 769-NXT.
 - E. Electric Alarm: The sprinkler contractor shall include a weatherproof audio visual (horn/strobe) device mounted on the outside of the building above the siamese connection. Include all conduit/wire etc. back to a reserved circuit breaker as well as to the flow switch.
 - F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts rated 10 amp at 115 volt AC. Basis of design: System Sensor.
 - G. Excess Pressure Pump (if determined necessary by Fire Protection Contractor):
 - 1. Type: Close coupled motor and pumped unit.
 - 2. Construction: Bronze with stainless steel shafts, carbon bearings.
 - 3. Performance: Determined by Fire Protection Contractor.
 - 4. Motor: Open drip proof, permanently lubricated, 115 volt, single phase, 60 hp. Hp determined by Fire Protection Contractor.
 - 5. Accessories: Include flexible hose connections, inlet strainer, relief valve.
- 2.10 AIR COMPRESSOR (If required for dry pipe system or double interlock preaction system)
- A. Duplex unit, electric motor driven, ASME rated horizontal receiver tank, air pressure operated electric switch, motor, motor starter with automatic mechanical alternator, safety valves, check valves, automatic tank drain, muffler-filter, belt guard, and controls. Size capacity to be determined by the Fire Protection Contractor.
- 2.11 PIPE HANGERS AND SUPPORTS
- A. Fire Protection Piping:
 - 1. Conform to NFPA 13 and NFPA 14.
 - 2. Hangers for Pipe Sizes 1/2 to 1 1/2 Inch: Malleable iron, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.12 DOUBLE CHECK VALVE ASSEMBLY

- A. A testable double detector check valve assembly with meter bypass shall be furnished and installed as required by local authorities.
- B. Provide on new fire protection systems, as well as on existing systems that are being altered, added to or changes. Coordinate exact requirements with local authorities.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. [Bevel or groove plain end ferrous pipe.]
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)
- E. Coordinate work of this Section with other affected work.

3.2 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, NFPA 24 for service mains and NFPA 70 National Electrical Code and all other applicable codes and regulations.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, and not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Slope piping and arrange systems to drain at low points.

- G. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- H. Grooved joint shall be installed in accordance with the manufacturer's written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor's representative is not considered qualified to conduct the training.)
- I. Do not penetrate building structural members unless indicated.
- J. Provide sleeves when penetrating footings, floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- K. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- L. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- M. Provide valves for shut-off or isolating service. Verify all code requirements for location and operation of all shutoff valves. Installation shall meet code.
- N. Provide drain valves at main shut-off valves, low points of piping and apparatus.
- O. Install equipment, sprinkler heads, miscellaneous materials, etc. in accordance with manufacturer's instructions.
- P. Locate and secure hose cabinet plumb and level. Verify height of top of cabinet (inside horizontal) surface above finished floor.
- Q. Locate angle valve in cabinet at required height above floor. Locate fire department connection below angle valve and not closer than 4 inches from side or bottom of cabinet.
- R. Connect standpipe system to water source ahead of domestic water connection.
- S. Where static pressure exceeds 100 psi at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi.
- T. Provide two-way fire department outlet connection on roof.
- U. Flush entire new piping system of foreign matter.
- V. Install buried shut-off valve in valve box. Provide post indicator.

- W. Provide double check valve assembly and required valving at sprinkler system water source connection.
- X. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle. Verify and get local fire department approval for location and type of connection.
- Y. Locate outside electric alarm bell on building wall. Coordinate location with Architect/Engineer.
- Z. Install and connect fire pumps in accordance with NAPA 13 and NFPA 70 (when required in design). Special attention shall be given to NFPA 70, Article 69S, including 695-12(d).
- AA. Install air compressor (when required) on vibration isolators and pipe receiver tank drain to nearest floor drain.
- BB. Place pipe runs to minimize obstruction to other work.
- CC. Place piping in concealed spaced above finished ceilings.
- DD. Center heads in two directions in ceiling tile and provide piping offsets as required. Coordinate location of piping, heads, etc. with ceiling layout, lights and all other trades. Location of all sprinkler heads shall be approved by the Architect.
- EE. Apply masking tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.
- FF. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.
- GG. Sprinkler bulb protectors shall be removed by hand. Do not use any tools or devices that could damage the bulb.
- HH. Install system main drain at low point of system. Extend drain piping to nearest janitor's sink with drain piping routed above ceilings if drain is located outside a mechanical room.

3.3 SYSTEM TEST

- A. Hydrostatically test entire system in accordance with NFPA 14.
- B. Test shall be witnessed by authority having jurisdiction. Architect/Engineer shall be notified.

3.4 QUALIFICATIONS

- A. A licensed Fire Protection Contractor shall design, detail and install a fire protection sprinkler system to cover the new and/or remodeled areas.

- B. The Fire Protection Contractor shall provide a flow test and furnish complete detailed CAD working drawings of the system and shall submit them to the Fire Marshal, Architect/Engineer and all agencies required by Code for review and approval.
- C. The Fire Protection Contractor shall include in their bid any cost for requesting CAD backgrounds or files for their use from the Architect or Engineer. At a minimum \$100.00 for the first file and \$50.00 for each additional file.

END OF SECTION

MAI: 2024-2701

SECTION 22 05 00

PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 RELATED SPECIFICATIONS AND DOCUMENTS

- A. Drawings and related specifications for this project including General and Supplementary Conditions, Division 1, General Requirements, Instructions to Bidders, Addenda's, etc. apply to and are considered a part of Division 22 - Mechanical Work.
- B. Information in this division is intended to clarify or make additions to the requirements set forth in the General Conditions, Supplementary Conditions, and Division I of these specifications. Any conflict between this Division 22 and other sections or divisions of the specifications or drawings shall be brought to the attention of the Architect/Engineer in writing as a request for addendum prior to the bid opening.
- C. Furnish all equipment, materials, articles, items, operations or methods listed, mentioned or scheduled on drawings, these specifications, manufacturer's installation instructions and include all labor, materials, equipment and incidentals necessary for their complete installation and operation.
- D. All information contained in this section applies to all sections within Division 22 as if it was part of each section.

1.2 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are intended to supplement each other and any material or labor called for in one shall be furnished even if not specifically mentioned in both. Any material or labor which is neither shown on the drawings nor listed in this specification, but is normally incurred or required for completion of work shall be furnished. If there is a discrepancy between the drawings and specifications, the more stringent of the two shall be followed.
- B. Drawings are diagrammatic and are intended to show approximate location and general arrangement of systems and equipment. No attempt has been made to show every ell, tee, etc. Drawings shall not be scaled for location of systems, equipment, etc. All dimensions whether given on drawings or scaled shall be verified in field and coordinated with all other trades and existing field conditions. Some plumbing, piping, equipment, etc. locations may require changes in location due to field conditions and coordination with other trades will be made with no additional cost to the Owner. Failure to check will be no reason for additional compensation.
- C. These drawings and the associated specifications are intended to provide complete furnishing, installation and operational plumbing systems as specified under Division 22 and as called for on the drawings. If these drawings and associated specifications have information omitted that would not allow a com

pletely operational system as is the intent of the Engineer, the bidder shall notify the Engineer a minimum one week prior to the bid date to allow for addenda. Once bids have been received, the Contractor shall be responsible for material, labor, etc., to furnish and install a completely operational plumbing system as is the intent of these drawings and associated specification.

- D. The installation of all systems, equipment, etc., is subject to clarification with submitted shop drawings and field coordination requirements. Equipment outlines shown on drawings or dimensioned on drawings are limiting dimensions. Any equipment that reduces the indicated clearances or exceeds specified or scheduled equipment dimensions shall not be used.
- E. The Architect/Engineer and Owner reserve the right to make minor changes in the location of equipment, piping, ductwork, etc. at the time of rough-in without additional cost to the Owner.
- F. The Mechanical Trades Contractor shall have completed for his portion of work, at least one installation of size and type comparable to this project and has been in satisfactory operation for at least two complete years. The Mechanical Trades Contractor shall also have a developed service department capable of negotiating service contracts with the Owner for systems herein specified.

1.3 AUTOCAD BACKGROUND FILES

- A. The Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$150.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Contractor.

1.4 MANUFACTURER'S SPECIFICATIONS AND CAPACITIES

- A. Some equipment, plumbing fixtures, materials, etc. that are scheduled on the drawings or listed in any addenda may not be specified in this specification. The manufacturer's specification and capacities shall be considered included and part of this specification whether it is specified in this specification or noted or scheduled on the drawings. The contractor shall remove and replace any "substituted" equipment or material, which has been installed or is on site, which in the opinion of the Architect/Engineer does not meet the scheduled equipment or materials, manufacturer's capacities or specification at no additional cost to the Owner.

1.5 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in pipe shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. CPVC: Chlorinated polyvinyl chloride plastic.
 - 3. PE: Polyethylene plastic.
 - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.6 LOCAL CONDITIONS

- A. Before submitting proposals, each contractor shall examine these specifications and associated drawings, addenda, etc. and shall examine the site of the project. The bidder shall fully investigate the site of this project, investigate coordination of his work with all other trades and existing conditions and completely satisfy himself as to the conditions to which the work is to be performed before submitting his/her bid. No allowances or considerations will be given at a later date for alleged misunderstanding as to the requirements of the work, materials to be furnished, or conditions required by the nature of this project site and coordination by the neglect on the bidder's part to make such an examination and coordination.
- B. Drawings show approximate location of existing services. The mechanical and electrical trades shall check with local utility companies or municipal agencies for exact location of services which they expect to encounter. The Mechanical Trades Contractor shall be responsible for hiring a company such as "Miss Dig" to stake out and locate all utilities in areas of excavation before commencing any work. The Mechanical Trades Contractor shall verify all elevations and locations of existing underground lines which are to be connected into or routed over or under. This verification shall be done prior to beginning work at this project.

1.7 QUALITY ASSURANCE

- A. All work shall be performed in accordance with all local and state codes, laws and regulations applicable to the work for this project. The contractor shall be responsible for all permits and costs for inspections, etc., and for checking with each utility company supplying service to this project and shall determine from them all, any changes in boxes, meters, valves, service, etc., and shall include all cost for inspections, revisions to services, etc. in his bid as required by local agencies, utilities, etc. No extra payment will be made for such items after the contractor submits his bid.
- B. In addition to all applicable Federal, State and local codes, the standards and codes listed below shall apply to all mechanical work. The reference to codes and standards shall be referenced to the latest edition or revision.
 - 1. American Gas Association (AGA)
 - 2. American National Standard Institute (ANSI)
 - 3. American Society of Mechanical Engineers (ASME)
 - 4. American Society for Testing materials (ASTM)
 - 5. American Water Works Association (AWWA)
 - 6. American Welding Society
 - 7. ANSI code of Pressure Piping and Unified Pressure Vessels
 - 8. Cast Iron Soil Pipe Institute
 - 9. National Electrical Manufacturer's Association (NEMA)
 - 10. Standards of the Hydraulic Institute
 - 11. Underwriters' Laboratories (UL)
 - 12. Williams-Steiger Occupational Safety & Health Act (OSHA)
- C. In the event of conflict between drawings, codes, standards or specifications, the most stringent requirement shall apply.

1.8 SUBMITTALS AND SHOP DRAWINGS

- A. Submit electronic sets of complete shop drawings for all plumbing equipment and materials associated with Division 22 and associated drawings to the Architect/Engineer for review before fabrication of work or ordering of equipment. Shop drawings shall be submitted at the earliest possible time.
- B. Shop drawings shall be first reviewed by the contractor. Inaccurate shop drawings shall be corrected by the contractor to meet specifications and schedules for this project. The contractor shall then initial the shop drawings as having been reviewed before submitting to the Architect/Engineer. Shop drawings shall have, in addition to the mechanical information, the electrical requirements for minimum circuit amperes and maximum fuse size ratings of the equipment.
- C. Drawings which are rejected must be corrected and returned for Architect/Engineer review before ordering.
- D. Furnish to the job site copies or prints of shop drawings that have been reviewed by the Engineer as soon as possible.

- E. Include a copy of each shop drawing in the Operation and Maintenance Manual.
- F. The checking and reviewing of shop drawings by the Architect/Engineer shall be construed as assisting the contractor and the Architect/Engineer's action does not relieve the contractor from the responsibility for errors or omissions which may exist thereon. The contractor shall be held responsible for errors or omissions that are discovered after approval process and must be made good by the contractor.

1.9 PERMITS, INSPECTIONS AND TESTS

- A. The Mechanical Trades Contractor shall take out all permits and arrange for necessary inspections and shall pay all assessments, fees and costs, etc., and make all tests as required by applicable codes. At the completion of the project, the Mechanical Trades Contractor shall furnish certificates of inspection and approval and secure final occupancy permit. Record copies shall be included in the Operation and Maintenance manuals.

1.10 RECORD DRAWINGS

- A. Maintain an up-to-date set of "record" drawings showing actual equipment, plumbing piping, etc. installation locations. Exact dimensions from column lines for all concealed work and tie-ins with elevations noted shall be included.
- B. Include a set of reproducible drawings and a set of prints in each Operation and Maintenance Manual.
- C. The Engineer reserves the right to request and be furnished any additional information he deems necessary to be shown on the record drawings.

1.11 OWNER'S INSTRUCTIONS

- A. Upon completion of the project, the contractor shall be responsible for instructing the Owner's operating staff, in the presence of the Architect/Engineer's representative, in the proper operation and maintenance of the mechanical systems and equipment. Include a statement signed by the Owner that instructions have been given for proper operation and maintenance of the mechanical systems and equipment.

1.12 GUARANTEES

- A. Furnish a written guarantee, to the Architect/Engineer, that will make the contractor responsible at his own expense for any imperfections in material and/or workmanship which may develop under ordinary use within a period of one (1) year from final Owner's acceptance of the work.
- B. Furnish all written guarantees from equipment and/or material manufacturers which shall include the operating and performance conditions and capabilities upon which they are based.

1.13 PORTABLE AND DETACHABLE PARTS

- A. Retain all portable and detachable parts of installation such as keys, spare accessories, operating manuals, etc. include in the Operation and Maintenance Manual.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. Furnish to the Architect/Engineer two (2) copies of an approved bound (3 ring binder) book with tabs for sections covering each item of equipment. These notebooks shall include shop drawings, maintenance manuals, operating manuals and parts lists to instruct the Owner on proper operation and use as well as maintenance for each piece of equipment. These books shall also include contractors', subcontractors' and manufacturers' names, telephone numbers and addresses.
- B. The manuals must be approved by the Architect/Engineer before final payment to the contractor. The Engineer reserves the right to request and be furnished any additional information that he deems necessary to be included in the manuals.

1.15 RESPONSIBILITIES FOR USE OF SUBSTITUTE MATERIALS

- A. Contractor shall notify Architect/Engineer in writing at least ten (10) calendar days before bids are due for approval to use materials and/or equipment other than that which has been specified or scheduled. If substitute materials and/or equipment are approved and used, it will be this contractor's responsibility to guarantee that the items will function as the specified equipment or materials, will in no way alter the design of the structure or system, and will not require any additional mechanical work such as piping, plumbing, etc. Any additional cost required by substitute materials will be the responsibility of the contractor.
- B. It will be the contractor's responsibility, at his own expense, to remove or replace any non-approved equipment or material or any approved equipment or materials not originally specified or scheduled if equipment and materials do not meet with the satisfaction of the Architect/Engineer.
- C. It shall be the Contractor's (Mechanical Trades) responsibility to coordinate and pay for any Electrical Contractor costs due to any changes in substitute materials and/or equipment's power requirements, which differ from that shown on the design documents.
- D. No consideration will be given to requests for substitute materials because of delivery problems unless the contractor can prove that orders were placed as soon as possible after contract was awarded and that delays were not caused by submittal of unscheduled or unspecified (substituted) materials to the Architect/Engineer.

1.16 COST BREAKDOWN AND EQUIPMENT LIST

- A. The successful bidder shall be responsible for submitting a cost breakdown to the Architect/Engineer and Owner within ten (10) calendar days after date of request of the breakdown. During progress of the work, if changes occur which cause additional cost, the price on such items shall be broken down in accordance with the items listed in the breakdown.
- B. The bidders shall be responsible for submitting a complete list of all equipment manufacturers, makes, models, etc. that will be used for this project with their proposal. The equipment list shall be typed on the contractor's letterhead and shall be signed by the authorized officer.

1.17 MATERIALS AND EQUIPMENT

- A. Materials and equipment furnished under this project shall have a minimum warrantee of one (1) year. All materials and equipment shall be new, of first class quality and shall be furnished, delivered, erected, installed and finished in every detail and shall be so selected and arranged as to fit into the building space. All material or equipment that is not specified but necessary for this project shall be subject to the approval of the Architect/Engineer.
- B. Any materials or equipment not specified or scheduled but similar to that which has had prior approval shall be listed as a substitution and noted on the proposal form as such.
- C. The contractor shall include all miscellaneous materials and labor required to completely install and operate the plumbing systems as is intended by these drawings and specification.

1.18 SCHEDULE, COORDINATION AND INSTALLATION OF WORK

- A. The contractor shall carry on work in such a manner as to meet the dates as scheduled by the General Contractor and shall work overtime at no expense to the Owner as required to comply with the schedule. This contractor shall schedule all work with Owner and Architect/Engineer and schedule shut down of systems with Owner.
- B. Examine the site and all drawings and specifications and coordinate work with all other trades before commencing work for this project. Arrange work essentially as shown with the exact layout to be made on the job to suit actual conditions. Precise locations of equipment and materials shall be coordinated and shall be the responsibility of this contractor. Should any conflicts in location occur, and necessary deviations from drawings are required as determined by the Architect/Engineer, the contractor shall make necessary adjustments without additional cost to the Owner.
- C. All equipment, plumbing piping, etc. shall be located and/or routed to allow for the most convenient access for servicing.

- D. Arrange for necessary access doors, panels, etc. to allow servicing of equipment, piping, valves, etc. Perform any cutting and patching as required, made necessary by failure to make proper arrangements.
- E. Indicated equipment connections, sizes and locations shall be verified and connected according to manufacturer's shop drawings and installation instructions. Thoroughly investigate the space provided for equipment and connections before ordering equipment. All equipment shall be selected to fit into the space allowed, including connections with adequate space allowed for operation and maintenance.
- F. All work shall be installed in a neat and workmanlike manner, using skilled personnel thoroughly qualified in the trade or duties that they are to perform. Rough work will be rejected.
- G. Coordinate all equipment deliveries and schedules to allow timely installation. Contractor shall separate equipment into sections and reassemble in building if required by the installation at no extra cost to the Owner.
- H. Furnish a superintendent approved by the Architect/Engineer to oversee and coordinate the work to be performed with all other trades.
- I. Coordinate location of pipes, plumbing, etc. with other building components such as structural components (beams, joists, columns, etc.), electrical components (lighting, conduits, etc.) and architectural components (walls, ceilings, floors, pipe chases, roof, etc.).
- J. Before starting work, Contractor shall verify that available space for proposed pipes, equipment etc. is adequate for the intended purpose and will result in a first class installation. Regardless of drawings, responsibility for first class operating systems rests with the Contractor.
- K. Arrange for chases, slots, openings, etc. and other building components to allow for plumbing systems installation. Coordinate cutting and patching of these components to accommodate installation. This contractor shall be responsible for accurately locating for the general trades all chases, shafts, etc. and shall be responsible for all cutting and patching if these chases were not accurate or not coordinated in time with the general trades. Coordinate installation of all sleeves in walls, floors or other structural or architectural components.
- L. Sequence, coordinate and integrate installation of equipment and materials for efficient work flow during the project. Particular attention should be spent on larger pieces of equipment.
- M. Install equipment and materials with provisions for necessary access for service and maintenance. Allow space for removal of all parts that may require replacement or servicing.

- N. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- O. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. When access panels are required, valves and equipment components requiring access shall be located to minimize the number of panels.
- P. Examine the work as it progresses and alert the Architect/Engineer in writing of any instances or obstructions that will prevent this contractor from performing his/her work.
- Q. The Mechanical Trade shall be responsible for all coordination of all site utilities, the gas company, etc. including coordination of all new and existing natural gas loads.

1.19 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. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.20 COOPERATION WITH ARCHITECT/ENGINEER AND OTHERS

- A. Coordinate all aspects of the plumbing system installation with all other trades, existing conditions, etc.
- B. If the bidder believes that changes in design are required to meet intended design capacities and operation or material and/or equipment is obviously omitted from these specifications and drawings, the bidder shall contact the Architect/Engineer in writing at least ten (10) days before bid date. The acceptance of a bid by the Owner shall be binding and shall indicate that the bidder does not require any changes in design nor additional costs in order to meet the design and performance of the mechanical system as indicated in these specifications and drawings.

1.21 WORK INVOLVING OTHER TRADES

- A. Equipment or materials specified in Division 22 may have to be installed by other trades (such as electrical trades or architectural trades) due to code requirements

or union jurisdictional requirements. Where this occurs, this contractor shall include all costs required by other trades to complete the work and hire the respective trade to perform this work.

1.22 PERFORMANCE DATA AND ACCESSIBILITY

- A. All performance data specified in this specification or scheduled on drawings shall be considered actual performance of the equipment after installation. The supplier and installer shall be responsible for suitable allowances to adjust equipment to design capacities when actual operating and installation conditions differ from drawings.
- B. All equipment and materials shall be installed to allow access for servicing and maintenance. Coordinate final location of such equipment and materials that are concealed with required access doors on panels. Allow ample space for replacement or servicing.

1.23 CUTTING AND PATCHING

- A. Unless noted otherwise, the Mechanical Trades shall be responsible for all cutting, patching and associated work required under Division 22. This work shall be performed by trades normally performing this type of work except drilling of holes shall be done by the contractor requiring same. This includes replacing areas of cutting required by this work with proper reinforcing, termite shielding, materials, finishing, etc. to restore the areas to their original condition, and filling all openings around ducts, piping, etc. with approved fire retardant materials. Regardless, all drilling of holes shall be the responsibility of the Contractor requiring same.
- B. If noted on drawings that the General Trades will be responsible for all cutting and patching, it will be the Mechanical Trades responsibility to notify all General Trades during bidding of all areas requiring cutting and patching. Regardless, all drilling of holes shall be the responsibility of the contractor requiring same.

1.24 WORK IN EXISTING BUILDINGS

- A. Coordinate and schedule all work in existing building with Owner and Architect/Engineer. Systems shall be kept in operation at all times if at all possible. If a system shut-down is required, the contractor shall schedule with the Owner, the time and length of shut-down. A system shall not be shut down without written permission from the Owner.
- B. All existing equipment, plumbing, piping, etc. that is to be removed shall remain the property of the Owner. The contractor shall remove and locate this material that remains the property of the Owner to a location determined by the Owner somewhere on site. If the Owner does not want to maintain possession of the removed material, the contractor shall be responsible for removing material from the site and disposing of this material as necessary to meet all codes and requirements and shall pay all costs as required for any disposal fees, inspections, permits, etc.

- C. All existing piping, equipment, etc. whether shown on drawings or not that is to be removed and/or abandoned and does not remain property of the Owner shall be removed from site.
- D. Any existing plumbing, piping, valves, mechanical equipment, etc. serving the existing building which are shown or not shown on drawings and are required for systems operation shall remain in use. If these systems require relocation to allow installation of new systems, the contractor shall be responsible for relocating to an Owner and Architect/Engineer approved location. The contractor shall pay all cost for this work and include such cost in his/her bid. (As specified previously, contractor shall be responsible for examining site and include all cost for work required to complete this project.)
- E. When active services, etc. are encountered in this project, the contractor shall furnish and install bracing, support, etc. as required to protect and keep these services active. (As specified previously, these drawings are diagrammatical. The contractor shall be responsible for verification of all existing services, piping, equipment, etc.).

1.25 ACCESS TO EQUIPMENT, VALVES, ETC.

- A. Coordinate access panels with type of construction and furnish access panels in areas that are non-accessible. Access panels shall be furnished by this contractor and installed by the General Contractor. The access panels shall be all approved, UL labeled and fire rated and shall be located and sized to allow access to equipment, valves, etc.
- B. Where access panels are required, valves, equipment etc. shall be located as to require the least number of access panels.

1.26 EQUIPMENT CONNECTIONS

- A. Connections to equipment, plumbing fixtures, etc. shall be made in accordance with shop drawings, rough-in dimensions furnished by the manufacturer, codes, etc. and may vary with connections shown on drawings. The contractor shall be responsible for making connections and number of connectors as per shop drawings, codes, etc. at no additional cost to the Owner.

1.27 ELECTRICAL CONNECTIONS

- A. The Electrical Trades shall be responsible for furnishing and installing all electrical equipment, wiring, etc. required for operation of mechanical equipment unless otherwise noted on the drawings. The Mechanical Trades shall furnish detailed information and wiring diagrams to the Electrical Trades for all equipment specified and/or scheduled for this project. In the event that the Mechanical Trades furnishes an "approved equal" or "alternate" that require changes in the original electrical design, the Mechanical Trades shall pay all costs to the Electrical Trades as required to make satisfactory adjustments. All electrical work shall be done in accordance with the latest edition of the National Electric Code.

1.28 MOTORS, MOTOR STARTERS AND DISCONNECTS

- A. Unless otherwise noted on drawings, motors shall be of constant speed 1750 rpm, new NEMA Design B, 40°C rise, horse power rated, open drip-proof except TEFC in dirty atmosphere, induction type motor with service factor of 1.15 and be of sufficient capacity to continuously operate the apparatus to which it is connected under all conditions of operation without exceeding nameplate ratings.
- B. Motors shall be premium efficiency as calculated using IEEE test method 112B.
- C. Motors ½ Hp. or larger shall be three phase; motors under ½ Hp. shall be 115 volt, 60 cycle, single phase. Before ordering the motors, the contractor shall verify correct motor voltage with the Electrical Trades and field conditions.
- D. The Mechanical Trades shall furnish, for equipment under Division 22, all special switches, disconnects, starters, alternators, etc. as specified or scheduled to be factory furnished and/or factory installed with the equipment including wiring diagrams, etc. whether it is to be factory installed or field wired. All other motor starters, disconnects, etc. not noted as factory furnished shall be furnished and installed by the Electrical Trades.
- E. Starters that are to be factory furnished with equipment shall be of the combination type and shall be as specified under Electrical Trades Division. Furnish overload protection for each phase.
- F. All wiring methods and materials shall meet NEMA, National Electric Code and State of Michigan Code requirements.
- G. All displays on control panels shall be on face of the panels.

1.29 EXCAVATION AND BACKFILLING

- A. Furnish all excavation, backfilling and removal of excess dirt to accomplish installation of Division 22 mechanical work unless otherwise noted on drawings.
- B. All excavation shall be by open cut from the surface. Contractor shall determine whether excavation shall be by machine or by hand except where existing utilities may be located where excavation shall be by hand. Contractor shall be responsible for all damage to existing facilities and services. Excavation shall be to a depth of at least 6" to allow granular bedding below pipe or duct.
- C. If for any reason the work is suspended, the contractor shall properly protect the excavation and leave the areas unobstructed.
- D. Trench width shall allow sufficient width at centerline of pipe to allow at all times a first class construction/installation method but in no case should be less than 12" larger than the nominal pipe or duct size. This shall especially be true in areas that joints must be connected. Joint holes may have to be made with overhanging sides to make installation safe for workmen.

- E. The excavation shall be at all times finished and backfilled to the required grade after completion and approval of work. Not more than 100 feet of trench shall be excavated and open unless written approval is given by the Architect/Engineer.
- F. The subgrade shall be 4" to 6" below the pipe of granular bedding graded and tamped by hand or mechanical means to the exact elevation required at the bottom of the pipe. Granular materials shall be approved fine aggregate meeting MDOT #2NS specifications. This material shall pass a ½" sieve but will be retained on a #4 sieve. If poor soil conditions exist which will not give proper support to the pipe, duct or structure, furnish granular fill as required to remedy this situation and give proper support.
- G. Furnish and install properly sloped sheet piled, shored and braced in areas that the soil requires this to maintain a proper excavation and prevent any movement of earth which could in any way damage the work under construction. When removing the sheeting and bracing, special care should be taken to prevent any caving of the sides of the excavation and injury to the completed work or adjacent property.
- H. Take all necessary action to keep trenches and other excavation areas free from water at all times. Use such methods as pumping, ditching, well pointing, etc. to prevent water in trench or excavation. Dewatering of trench shall have constant supervision.
- I. Backfill excavation and trenches with approved granular material around sides of pipe and at least 12 inches above the top of the pipe laid not more than in 6 inch layers that are thoroughly tamped to 95% of its maximum density. There shall be no backfilling by any mechanical means until the granular material has been firmly tamped around the entire pipe to 12 inches above the pipe. All material used for backfilling shall be approved by the Architect/Engineer. Wherever trenching crosses walks or roadways or isolated inside of building, backfill top 6'-0" of trench with sand or bank run gravel in layers not to exceed 6 inches in depth and carefully compact by hand or machine. Do not backfill with frozen materials.
- J. No piping shall be covered until it has been tested, inspected and approved. Upon completion of backfilling, grade shall be restored in indicated elevation and left in reasonable condition for finish grade by others unless otherwise noted on drawings.
- K. Before final acceptance of work, all disturbed streets, drives, curbs, walks, parking areas, etc. shall be paved, graveled or other to as near their original condition as possible. All unused excavated material shall be removed from site if directed by the Architect/Engineer.

1.30 BASES AND SUPPORTS

- A. This contractor shall be responsible for furnishing all equipment pads and supports for equipment and materials required by Division 22 unless otherwise noted on drawings.

- B. All floor mounted mechanical equipment shall have a reinforced concrete pad furnished unless otherwise noted on drawings. The concrete pads shall be tied to the building floor with expansion bolts located maximum of 4'-0" on centers with a minimum of four (4) bolts, set before pouring and concealed within the pad. The Mechanical Trades shall verify exact pad or support size with the equipment manufacturer and shall size pad with adequate area to allow sufficient room for equipment mounting hardware, etc. Concrete pads shall have a 45 degree bevel at the top edge. The contractor shall verify exact location of concrete pads.
- C. Furnish all steel, hanging material, rods, etc. for suspending equipment off floor unless otherwise noted on drawings for equipment to be furnished under Division 22. This includes all structural steel for supporting between beams.
- D. All support structure shall be of strength to safely withstand all stresses and loads to which they will be subjected and shall distribute load properly over the building area. Supports shall be designed to avoid undue strain to equipment and to avoid interference with piping, pipe connections, service and maintenance clearances, etc.
- E. Where equipment is to be floor mounted and requires legs, this contractor shall furnish and install structural steel members or steel pipe and fittings for legs. Fasten and brace to equipment and furnish flange at base to allow bolting to floor.
- F. Where equipment is to be ceiling or wall mounted, furnish necessary platform, structural steel, hardware, etc. as is most suitable for support of this equipment.
- G. All supports shall be approved by the Architect/Engineer.
- H. All piping, plumbing, etc. shall be suspended from structural steel members utilizing rods and approved hanger devices. Do not use metal deck for support. Beam clamps such as the Grinnell Fig. 260 or approved equal shall be used. Sheet metal "straps" shall not be used in place of rods.
- I. The mechanical trades shall be responsible for furnishing and setting in place all mechanical equipment, roof curbs and plumbing, piping roof curbs. The general trade shall be responsible for the roof work and associated flashing. The mechanical trade shall furnish and install treated wood base blocking as required to level curb and to match roof insulation thickness. Curb shall be as specified, or if not specified should be similar to Pate or Thy-curb with heavy gauge galvanized steel, insulated and with wood nailer. Height of curb scheduled or specified shall be height required to top of curb above finished roof. If height is not specified or noted, a minimum 12" high above finished roof will be required. (pipe support units shall be at height required).

1.30 SLEEVES, PLATES AND COLLARS

- A. Furnish all sleeves, plates and collars for plumbing piping, etc. passing through walls, floor ceilings, foundations, etc. Coordinate with the General Contractor the exact location and size of required openings. No pipe shall pass through a wall, floor ceiling, etc. without a sleeve. This contractor shall be responsible for sleeve locations and securing sleeves before concrete is formed.

- B. Sleeves for steel pipe shall be standard weight black steel pipe. For walls, foundations and ceilings, sleeve shall be kept flush with finished surfaces. For floors, the sleeve shall be set flush with bottom of concrete construction and be extended up ¼" above concrete floor. Sleeves shall be set in place before construction of walls, floors, ceilings, etc.
- C. Sleeves for copper pipe shall be type "M" hard copper tubing installed typical to that of steel pipe sleeves.
- D. Sleeves for piping shall be sized to allow insulation to run continuous through sleeve whenever possible and to allow not less than ¼" all around bare pipe or insulation.
- E. Where insulated piping passes through walls or floor sleeves, furnish 22 gauge galvanized band around insulation of same length as the sleeve length. Band shall fit snugly over insulation and be held in place by steel metal collars all around insulation to cover openings.
- F. All penetration voids shall be sealed smoke tight with non-combustible materials similar to 3M or Hilti firestop systems to maintain the integrity of the fire rated structure. In a non-rated assembly, seal all voids with non-hardening sealant.
- G. Where bare piping 2" and smaller pass through wall or floors, furnish polished chrome plated brass escutcheons, split type. Bare piping 2½" and larger that pass through walls or floor, furnish 22 gauge galvanized steel metal collars so as to cover opening.
- H. Where piping penetrates an outside wall, below grade, utilize a mechanical sleeve, similar to Link-Seal, with stainless steel nuts and bolts on fasteners.

1.31 RIGGING AND HOISTING

- A. Perform all required rigging, hoisting, transportation, moving, etc. of all equipment, materials, etc. to be furnished and/or installed under Division 22 whether furnished by this contractor or by the Owner or other trades.

1.32 STORAGE FACILITY

- A. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.33 PROTECTION FROM DAMAGE

- A. The contractor shall be responsible for all materials, equipment, etc. and all work installed by himself and shall protect it from damage until final acceptance of this project by the Owner.

- B. Furnish all coverings and protection from dirt, dust, rain, storm, heat, traffic, wear, etc. and all possible injury including that by other workmen. Any equipment, workmanship, materials, etc. damaged prior to final acceptance by the Owner of this project shall be properly repaired at no expense to the Owner.
- C. Protect all plumbing fixtures and other equipment from damage by covering or coating. Any dented, scratched, rusted or marred surface finishes will not be accepted.
- D. Protect all equipment, materials, etc. from freezing.

1.34 COMMON PIPE MATERIALS AND INSTALLATION INSTRUCTIONS

- 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. Refer to individual Division 22 piping Sections for special joining materials not listed below.
 - 1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - b. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - 3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
 - 4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 - 5. 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.
 - 6. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
 - 7. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
 - 8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

1.35 PIPE HANGERS AND SUPPORTS

- A. Hangers and saddles shall be Modern Pipe Support Corp., Grinnel/Anvil, Autogrip, or M-CO. Inserts shall be of the type to receive a machine bolt head or nut after installation, permit horizontal adjustment, and shall be flush with the surface. For copper pipe with steel hangers, clean and wrap pipe with two layers of plastic insulating tape at point of contact. Roller supports shall be adjustable type with insulated standoff. Rods shall be used for suspended installation. Sheet metal "straps" shall not be used in place of rods.
- B. Hangers for piping with vapor barrier sealed insulation shall be multipurpose pipe saddles fitting over the insulation. Wire or perforated strap iron will not be permitted for pipe supports. Do not support hangers from roof deck. Furnish and install all support steel as required to suspend from structural steel joist or beams. Hangers shall be clevis or split ring type with vertical adjustment and beam clamp similar to Grinnell/Anvil Fig. 260, with maximum spacing per ASHRAE Standards:

Pipe Size	Steel Pipe	Copper Pipe	PVC Pipe	Rod Size
½ to ¾ inch	6 feet	5 feet	4 feet	3/8"
1 inch	7 feet	5 feet	4 feet	3/8"
1 ¼ inch	7 feet	7 feet	4 feet	3/8"
1½ inch	7 feet	7 feet	4 feet	1/2"
2 inch	10 feet	8 feet	4 feet	1/2"
2½ inch	11 feet	9 feet	4 feet	5/8"
3 inch	11 feet	9 feet	4 feet	5/8"
3 ½ inch	13 feet	11 feet	4 feet	5/8"
4 inch	14 feet	12 feet	4 feet	3/4"
5 inch	14 feet	12 feet	4 feet	3/4"
6 inch	14 feet	--	4 feet	3/4"
8 inch	16 feet	--	4 feet	7/8"
10 inch	16 feet	--	4 feet	7/8"
12 inch	20 feet	--	4 feet	1"

- C. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
- D. Hangers for Pipe Sizes ½ to 1½ Inch: Malleable iron, adjustable swivel, split ring.
- E. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- F. Hangers for Hot Pipe Sizes thru 4 Inches: Carbon steel, adjustable, clevis.
- G. Hangers for Hot Pipe Sizes 5 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- H. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

- I. Wall Support for Pipe Sizes up thru 3 Inches: Cast iron hook.
- J. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- K. Vertical Support: Steel riser unistrut clamps at high, mid, and low locations.
- L. Floor Support for Cold Pipe all sizes and Hot Pipe Sizes up thru 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- M. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- N. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- O. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustments, top slot for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

1.36 PLUMBING, PIPING, AND EQUIPMENT SUPPORT

- A. Attachments of mechanical equipment to structural members are the responsibility of the installing trade. Structural members shall not be field cut, welded or otherwise modified without approval of the Architect/Engineer. Attachment to steel joist shall be made at panel points. When routing piping or ductwork perpendicular to joist, a support shall be provided at every steel joist; when parallel to joist, a support shall be provided at no more than 6' on centers or two panel bays. Structural members shall not be overloaded as a result of attachments. Attachment/equipment loading for all trades resulting in total load greater than an equivalent uniform 5 psf for any member shall be submitted to the Architect/Engineer for review. Mechanical Trades may contact the project Structural Engineer as required for panel point location assistance and welder certification requirements. Electrical Trades are still responsible for design, layout, and fabrication and installation of electrical supports and support attachment methods. Mechanical Trades shall submit attachment methods to the Structural Engineer for review.
- B. Install products in accordance with manufacturer's instructions.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut structural members without permission from Architect/Engineer.

- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

1.37 PIPING SYSTEMS SHUT OFF VALVES

- A. Shut off valves shall be installed at all branch lines off main piping, or where mains divide/separate to serve different areas, to allow isolation of all branch piping and systems they serve such as toilet rooms, areas or wings of the building, etc.

1.38 CLEANING AND FINISHING

- A. During construction period, remove all debris, rubbish, tools, equipment, unused materials, etc. as required or requested by the Architect/Engineer. All cost for cleanup and removal will be the responsibility of the contractor.
- B. Upon completion of the project and before final acceptance by the Owner, the entire installation shall be thoroughly cleaned, all rubbish and unused material removed to the satisfaction of the Architect/Engineer. All dust and dirt shall be removed from all equipment, piping, ductwork, etc.
- C. Thoroughly clean all floor drains, cleanouts, and plumbing fixtures. Clean all trays and strainers.
- D. Finish paint all equipment, materials, piping, etc. as noted on drawings or listed in this specification. Match Owner's existing color scheme. Any Division 22 equipment which has been scratched or damaged shall be finished equal to the original finish.

1.39 EQUIPMENT/SYSTEMS START-UP

- A. Furnish and schedule manufacturer's start-up service for all equipment and systems. These start-up services shall be performed in the presence of, and to the satisfaction of the Owner and Architect/Engineer.

1.40 EQUIPMENT/SYSTEMS SIGN-OFF

- A. The Mechanical Trades shall furnish written sign-offs on all systems stating that the equipment and systems have been checked, tested, started and that their operation has been verified correct through the entire range of operation that can be expected through the seasons.

1.41 SUBSTANTIAL COMPLETION

- A. Contractor shall submit a letter to the Architect/Engineer advising that all work has been completed in accordance with plans and specifications and the project is ready for a final walk-thru.

END OF SECTION

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SECTION 22 05 10

PLUMBING SYSTEMS TESTING, CLEANING, WATER TREATMENT & STARTUP

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing of piping systems.
- B. Cleaning of piping systems.
- C. Chemical treatment.
- D. Substantial completion check list and sign-off forms.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself, but is supplementary to the entire specification and drawings.

1.3 SCOPE OF WORK

- A. The work covered by this specification consists of furnishing all labor, equipment, material, chemicals or methods that are mentioned, listed or scheduled on drawings or are in this specification. This includes all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the cleaning, flushing, testing and chemical treatment of the piping systems for this project. The work covered under this section of the specification is in no way complete within itself, but is supplementary to the entire specification and drawings.
- B. The substantial completion forms shall be required to be signed and submitted to the Architect/Engineer for approval prior to any insulation of piping systems or installation of ceiling tiles. The person that signs the substantial completion forms shall witness the testing, flushing and chemical treatment of the systems. The signature person's company shall be responsible for all cost incurred with future work by the Architect/Engineer or Owner due to inadequate testing, cleaning, operation or chemical treatment of the piping systems.

1.4 SUBMITTALS

- A. Submit electronic copies of the completed and signed substantial completion forms included in this section. Submit to the Architect/Engineer as system flushing, testing, and chemical treatment occurs. The Mechanical Trade shall maintain one

set of substantial completion forms and submit them to the Architect/Engineer prior to the Architect/Engineer final project walk-through.

- B. Submit electronic copies of all equipment, chemicals and product data being furnished to this project for approval.
- C. Submit electronic copies of manufacturer's installation instructions, including placement of equipment in systems, piping configuration, and connection requirements.
- D. Submit certificate of compliance from authority having jurisdiction, indicating approval of systems that require review by local and state authorities.

1.5 PROJECT RECORD DOCUMENTS

- A. Record actual installation locations of piping and equipment including sampling points and location of chemical injectors.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for public sewage systems.
- B. Products requiring electrical connection and listed and classified by UL as suitable for the purpose specified and indicated.

1.7 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems and system water for one year from date of substantial completion.
- B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report to Owner after each visit.
- C. Provide laboratory and technical assistance services during this maintenance period.
- D. Provide training course for Owner's personnel, instructing them on installation, care, maintenance, testing, and operation of the water treatment systems. Arrange course at startup of systems.
- E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based on these inspections.

1.8 MAINTENANCE MATERIALS

- A. Provide sufficient chemicals for treatment and testing during warranty period.

PART 2 PRODUCTS

2.1 WATER METER

- A. Displacement type cold water meter with sealed, tamper-proof magnetic drive, impulse contact register, single pole, double throw dry contact switch.

2.2 WATER SOFTENERS

- A. Softener Tank: Glass fiber reinforced plastic tank.
- B. Brine Tank: Glass fiber reinforced plastic tank.
- C. Control: Brass control valve cycled to regenerate from one to twelve day period.

PART 3 - EXECUTION

3.1 SANITARY AND STORM PIPING SYSTEMS

- A. Testing
 - 1. Conduct a water, air or peppermint test on the entire system in accordance with the State Plumbing Code. Test underground sanitary, storm and vent piping with at least a 10 foot head of water.

3.2 DOMESTIC COLD WATER, HOT WATER & HOT WATER RETURN PIPING SYSTEMS

- A. Testing
 - 1. Before any fixtures are connected, hydrostatically test piping system at 1.5 times the maximum system pressure, but not less than 100 psig in excess of working pressure for (4) hours. This pressure to be on piping only, not equipment.
- B. Cleaning, flushing and disinfection.
 - 1. All domestic water piping and equipment shall be completely flushed out and disinfected before placing system in service. Disinfection procedure and results shall be in accordance with all applicable codes and State Department of Public Health. (Piping shall be flushed until water is clear).
 - 2. Ensure pH of water to be used as treatment is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or Acid (hydrochloric).
 - 3. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L (50ppm) minimum residual.
 - 4. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
 - 5. Maintain disinfectant in system for 2 hours.
 - 6. If final disinfectant residual tests less than 25 mg/L, repeat test.

7. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L or 0.5 ppm maximum.
8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and water entry, and analyze in accordance with AWWA-C51.
9. Verify that all tests and results are in accordance with local and state health codes and regulations.

3.3 NATURAL GAS PIPING SYSTEMS

- A. Pressure Test
 1. Pressure test shall be per the current adopted edition of the International Fuel Gas Code.
 2. The test pressure shall not be less than 1.5 times the working pressure but not less than 3 PSIG. Where the test pressure exceeds 125 psig, the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe. The test duration shall be not less than ½ hour for each 500 FT³ of pipe volume. If testing a system with less than 10 FT³ of pipe volume the test shall not be less than 10 minutes.
 3. The test medium shall be air, nitrogen, carbon dioxide or an inert gas. Oxygen shall not be used.

3.4 SYSTEM COMPLETION CHECKLIST

- A. The checklist which follows this specification section is to be considered part of the specifications.
- B. The checklist is to be completed by the Installing Contractor and the prime Mechanical Contractor for each item as directed.

END OF SECTION

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Hunger Solution Center,
Saginaw, Michigan.

SYSTEMS COMPLETION CHECKLIST						
Inspection/Review Item	Notice Required	Installing Contractor		Date	Owner's Representative Signature	Remarks
		Name	Signature			
Plumbing Systems						
Testing of Sanitary and Storm Systems	48 hours					Tested per specification
Testing of Domestic CW, HW and HWR Piping.	48 hours					Tested per specification
Disinfection of Domestic CW, HW & HWR Piping.	48 hours					Disinfect per specification and all applicable codes.
Domestic Water Sample and Approval	When submitted					Submit sample for review and approval by local authorities.
Natural Gas Piping	7 days					Tested per specifications.
Domestic water heater system, completely installed, checked, tested and started	7 days					Verify system installation complete, operation correct. Includes verification of hot water recirculating pump system and flow balance. Check, test and startup by Manufacturer's Rep.
Valving	When completed					Verify that valves have been installed at all branch piping locations
Piping and Fitting Insulation	When Completed					Verify all piping and fitting are insulated per specification.
Reduced Pressure Backflow Preventer Tested	48 hours					Verify Reduced Pressure Backflow Preventer installed and completely operational.
Sump Pumps and Sewage Ejectors	48 hours					Verify system installation complete and operational.

By signing this form, the Contractor is certifying that he has personally witnessed completion of that item, and it is complete and complies with all respects to the drawings and specifications.

All items are to be signed off on and submitted to MacMillan Associates Inc. before a final project walk-thru by the Engineer is requested. If the Engineer discovers items incomplete and/or not in accordance with this checklist, the drawings, or the specifications, the Contractor will be backcharged for the Engineer's time and expenses.

Hunger Solution Center,
Saginaw, Michigan.

SYSTEMS COMPLETION CHECKLIST						
Inspection/Review Item	Notice Required	Installing Contractor		Date	Owner's Representative Signature	Remarks
		Name	Signature			
Plumbing Systems, Continued						
Pipe Labeling and Valve Tagging Identification	When completed					Verify system identification is complete per specification and valve chart submitted.
Owner's Training	7 days					Verify that Owner has been instructed on operation and maintenance of systems.

By signing this form, the Contractor is certifying that he has personally witnessed completion of that item, and it is complete and complies with all respects to the drawings and specifications.

All items are to be signed off on and submitted to MacMillan Associates Inc. before a final project walk-thru by the Engineer is requested. If the Engineer discovers items incomplete and/or not in accordance with this checklist, the drawings, or the specifications, the Contractor will be backcharged for the Engineer's time and expenses.

SECTION 22 05 53

PLUMBING SYSTEM IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Medical Gas Systems: Supply of pipe labels for placement by this Section.

1.3 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. ANSI or equal standards for the Identification of Piping Systems.

1.4 SUBMITTALS

- A. Submit list of working, symbols, letter size, and color coding for mechanical identification.
- B. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color. Furnish and install on all mechanical equipment.

2.2 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1½ inch diameter with smooth edges.

- B. Chart: Typewritten letter size list in anodized aluminum frame.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. $\frac{3}{4}$ to $1\frac{1}{4}$ inch Outside Diameter of Insulation or Pipe: 8 inch long color field, $\frac{1}{2}$ inch high letters.
 - 2. $1\frac{1}{2}$ to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, $\frac{3}{4}$ inch high letters.
 - 3. $2\frac{1}{2}$ to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, $1\frac{1}{4}$ inch high letters.
 - 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, $2\frac{1}{2}$ inch high letters.
 - 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, $3\frac{1}{2}$ inch high letters.
 - 6. Ductwork and Equipment: $2\frac{1}{2}$ inch high letters.
- B. Stencil Paint shall be semi-gloss enamel, colors conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color: Match existing or conform to ANSI/OSHA standards.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

- A. Description: Steel with $\frac{3}{4}$ inch diameter color coded head.
- B. Color code as follows:
 - 1. Green - Plumbing valves

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces as required by manufacturer's installations for stencil painting.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify each piece of equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic tape pipe markers or stenciled painting. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 06 00

PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General information for piping systems, plumbing fixtures, backflow preventers, water heaters, sump and sewage pumps, etc. and general installation information.

1.2 FIELD MEASUREMENTS

- A. Field verify all equipment and fixture locations.
- B. Confirm that mill work is constructed with adequate provisions for the installation of countertop plumbing fixtures.
- C. Confirm all mounting heights and locations of plumbing fixtures to meet all barrier free and American Disabilities Act codes and regulations.

1.3 EQUIPMENT, FIXTURE & MISCELLANEOUS SPECIFICATIONS

- A. All equipment, plumbing fixtures, specialties, etc. that have been scheduled on drawings shall have the manufacturer's specification automatically included as part of this specification. All "approved substitute" or "voluntary alternate" equipment fixtures, etc. shall meet the capacities, quality, etc. of the scheduled items specification and capacities.

PART 2 PRODUCTS

2.1 PIPE AND PIPE FITTINGS

- A. See Section 22 10 00 for Plumbing Piping.

2.2 MATERIALS AND FINISH

- A. Fixtures shall be of best quality vitreous china, acid resisting enameled cast iron or stainless steel, free from discoloration, chips, dents, warps, flaws, cracks, scratches, etc. or other blemishes. All vitreous china and enamel shall be white unless otherwise noted. Fixtures shall have manufacturer's guarantee label or trademark indicating first quality.
- B. All exposed pipe, fittings, traps, wastes, faucets, valves, handles, escutcheons, bolts, screws and accessories shall be polished chrome plated brass unless noted otherwise. Exposed traps shall be chrome plated brass, adjustable with cleanout plug and escutcheon.

2.3 PLUMBING FIXTURES - GENERAL

- A. Furnish all fixtures as shown and scheduled on drawings.

- B. Unless noted as “no substitutions”, similar fixtures by the following manufacturers with equal or better qualities will be accepted as equal for:
 - 1. Drainage Specialties - Josam, Sioux Chief, Smith, Wade, Watts, Zurn
 - 2. Plumbing Fixtures - American Standard, Bradley, Crane, Elkay, Fiat, Florestone, Just, Kohler, Mansfield, Moen Commercial, ProFlo, Sloan, Stern-Williams, Zurn.
 - 3. Plumbing Specialties – Schier, Watts, Wilkins, Zurn.
 - 4. Flush Valves - Delany, Delta, Sloan (Royal), Zurn, American Standard.
 - 5. Faucets - American Standard, Chicago, Delta, Sloan, T & S, Woodford, Zurn.
 - 6. Toilet Seats - Bemis, Centoco, Church, Olsonite, Kohler.
 - 7. Mixing Valves and Accessories - Powers, Symmons, Watts, Zurn, Reliance, Conbraco Appollo.
 - a. See 2.22 (this section) for emergency showers and eyewash stations.
 - 8. Electric Water Coolers and Drinking Fountains: Elkay, Halsey Taylor, Haws, Oasis.
- C. Provide all chair carriers, mounting hardware, etc. as required by the plumbing fixtures and wall construction. Where fixtures are located on walls, furnish and install suitable steel shapes well anchored in place and supported from floor as necessary to support fixtures. Each fixture shall be supported solidly and shall be sufficiently strong to withstand severe usage.
- D. Where plumbing fixtures occur in walls with pipe spaces in back of same, the supports for fixtures shall consist of chair carriers built into the wall with bolt projecting through face of wall for attachments of fixture brackets.

2.4 BACKFLOW PREVENTER

- A. Furnish and install type and quantity as shown on drawings or required by code. The Mechanical Trades shall furnish certification of all backflow preventers.
- B. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013 and AWWA C506; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer and four test cocks.
- C. Double Check Valve Assemblies: ANSI/ASSE 1012 and AWWA C506; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

2.5 WATER HAMMER ARRESTORS

- A. Furnish and install on systems as required by local and state plumbing codes, latest edition.
- B. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psig working pressure.

2.6 DOMESTIC WATER HEATER

- A. Refer to drawings and furnish all.

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate cutting and forming of roof and floor construction to receive drains to required invert and rim elevations.
- B. Coordinate all rough-in and/or final connections to equipment and plumbing fixtures. Plumbing fixtures shall be located as required to meet all barrier free and American Disabilities Act codes and regulations.
- C. Coordinate all piping invert elevations, location, routing, etc. to allow proper drainage from all plumbing fixtures to sewer mains. Verify all services existing and new for elevations, locations, etc. before commencing installation.

3.2 FIXTURE CONNECTIONS

- A. In general, unless otherwise noted on the drawings, the sizes of all the branch connections to fixtures shall be no smaller than those listed in the following schedule and as required by local and state plumbing codes, latest edition:

Fixture	Waste	Vent	C.W.	H.W.
Lavatory	1¼"	1¼"	½"	½"
Sinks (General)	1½"	1½"	½"	½"
Janitor's Service Sink	3"	2"	½"	½"
Water Closet-Flush Valve	4"	2"	1¼"	---
Urinal-Flush Valve	2"	2"	1"	---
Wall Hydrants (Hose Bibb)	---	---	¾"	---
Drinking Fountain	1½"	1½"	½"	---
Showers	2"	2"	¾"	¾"

3.3 INSTALLATION

- A. Plumbing fixtures and trim shall be protected against damage during construction. Fixtures damaged during this period shall be replaced.
- B. All valves, waste and water supply piping servicing fixtures exposed beyond face of finished walls shall be brass, nickel, and chromium plated. Where fixtures are mounted in countertops and cabinet work concealing valves and piping, chrome plated brass finishes are not required.
- C. All fixtures shall be independently valved with either integral stops or brass stops.
- D. Waste connections to floor or wall outlet fixtures shall be gas and water-tight; fastened with an approved setting compound, gasket or washer. Rubber gaskets or putty are not acceptable. The fixture shall be set the proper distance from the wall or floor.

- E. Where flush valves are specified with fixtures, supply to valve in each room shall be set at same height for that type of fixture, and valve shall be set in place so that center line of valve discharge is directly above center line of fixture spud. Bending of nipple between valve and spud to achieve connection will not be permitted.
- F. All brackets, cleats, plates, anchors, etc. required to support fixtures or piping rigidly in place shall be provided as work of this section and shall be installed behind finished walls.
- G. Provide and install basic fixtures from one major fixture manufacturer. Also, accessories such as faucets, strainers, stops, traps, etc. shall be manufactured by one major company where possible.
- H. All fixtures shall be set rigid, tight, plumb, level and true to assure rigidity and permanence. Provide chair carriers as manufactured by Wade, Josam, Zurn, or J.R. Smith for wall mounted fixtures. Carriers for wall mounted lavatories, drinking fountains, water coolers, and urinals shall have dual foot supports, tubular uprights, adjustable headers, alignment trusses, and all necessary accessories. Lavatory carriers shall be with concealed arms. Urinal carriers shall be with bearing plate. Water cooler and drinking fountain carriers shall be as required for proper support.
- I. All wall mounted fixtures shall be tested by bearing the weight of 500 pounds without sagging or pulling away from the wall. Damage resulting from this test shall be made good by this contractor. All other piping and fixtures shall be secured to walls with wall plates, wall hangers and approved expansion shields and bolts.
- J. Connections between earthenware fixtures and soil pipe flanges shall be made gas and water tight with closet setting compound or approved Neoprene gaskets, without use of putty. Hold down bolts shall be brass, not less than 1/4" in diameter, and shall be equipped with nuts and washers.
- K. Provide each fixture with an approved compression service stop. Exposed stops shall be either loose key or screwdriver type.
- L. Caulk joint between wall and fixture at wall mounted lavatories, water closets, urinals, drinking fountains and service sinks with Silicone Sealant, white.
- M. Conductors:
 - 1. All inside conductors, except as otherwise specified, shall be caulked water tight and supported so as to provide for contraction, expansion and settlement of the building.
 - 2. All connections between outlet at roof drains and conductors shall be made and caulked watertight. Install all inside conductors and cooperate with the roofing contractor to properly install connections to the roof drains.
- N. Cleanouts:
 - 1. All soil, waste and drain pipes shall have cleanout at foot of stacks, outside near wall where line leaves building, at every change in the direction of run, at upper end of all horizontal runs, at intervals of not more than 100'-0" in straight runs of sanitary sewers and as required by code. All outlets shall be

accessible so that drain line may be readily cleaned with a snake or other rodding tool. Extend cleanouts to finished floor or finished wall.

- O. Floor Drains
 - 1. Floor drain pans shall be furnished and installed for all floor drains (except when floor drain is located in floors on fill) and be made of lead sheets weighting 4 lbs. per square foot or of an approved material, extending a minimum of 12" beyond lip of the flashing ring with outer edges turned up. All floor drains, floor sinks, etc. shall have deep traps installed.
 - 2. All fixtures shall be trapped if required by local or state plumbing codes.
 - 3. All trap seals that are subject to loss by evaporation shall have a trap seal primer valve installed as required by Local or State Plumbing Codes. A trap seal primer valve shall conform to ASSE 1018 or ASSE 1044.
- P. Flashings: Vent pipe flashings shall be by roofing contractor. Provide lead sleeves for vents.
- Q. Roof Drains: Furnish roof drains as scheduled on drawings, and all other accessories as required for installation and as recommended by the drain manufacturer. The General Contractor will be responsible for roof openings, roof opening supports and flashings.
- R. Roof drain pans shall be furnished and installed for each roof drain and overflow roof drain. Pans shall be pre-cut 30"x30" and shall be recessed 1½" deep. Deliver pan to general contractor for installation by roof deck trades.
- S. Pipe relief from backflow preventer to nearest drain.
- T. Install water hammer arrestors as required by Code, complete with means for access if so required by the Plumbing Inspector.
- U. Cold water supply branch to each toilet room shall be provided with shock absorbers designed and sized as recommended by the manufacturer to eliminate water hammer.
- V. All exposed supplies and valves in finished areas shall be brass chrome plated. Supply lines to all hanging fixtures shall be from the wall, unless otherwise noted on drawings.
- W. Install shutoff valves on all branches. All water supplies to fixtures shall have valve on supply line to the fixture.
- X. All plumbing fixtures shall be installed, vented, piped, trapped, etc. in accordance with all codes and regulations pertaining to this projects location.
- Y. Provide access to all thermostatic mixing valves and trap primer valves. If necessary, provide flush mounted stainless steel valve box with hinged cover and key lock.
- Z. All fixtures supplied for bathing shall be supplied with a temperature control valve that conforms to ASSE 1016. All fixtures for hand washing shall be supplied with a temperature control valve that conforms to ASSE 1070.

END OF SECTION

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SECTION 22 07 00

PLUMBING PIPE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES PIPE INSULATION FOR:

- A. Domestic water piping system including cold water, hot water and hot water return.
- B. Horizontal rain water conductors.
- C. Horizontal and vertical overflow rain water conductors.
- D. Underside of roof drains.
- E. Valves and fittings.
- F. Miscellaneous.

1.2 REFERENCES

- A. Thermal insulation materials shall meet the property requirements of the following specifications as applicable to the specific product or end use:
- B. American Society for Testing of Materials Specifications:
 - 1. ASTM C547, "Standard Specification for Mineral Fiber Preformed Pipe Insulation"
 - 2. ASTM C533, "Standard Specification for Calcium Silicate Pipe & Block Insulation"
 - 3. ASTM C585, "Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)"
 - 4. ASTM C1136, "Standard Specification for Barrier Material, Vapor," Type 1 or 2 (jacket only)
- C. Insulation materials, including all water and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings, plans, and specifications.

1.3 SCOPE

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to the following commercial piping systems, in accordance with the applicable project specifications and drawings, subject to the terms and conditions of the contract:
 - 1. Hot Piping – Piping system with fluids 105°F and higher.
 - 2. Cold Piping – Piping systems with fluids below 105°F. (Includes storm water systems)

- B. Insulation, vapor barriers, jacketing, hangers, supports, accessory materials, etc. shall be installed according to manufacturers recommendations.

1.4 DEFINITIONS

- A. The term "mineral fiber" as defined by the above specifications includes fibers manufactured of glass, rock, or slag processed from a molten state, with or without binder.

1.5 SYSTEM PERFORMANCE

- A. Insulation material furnished and installed hereunder shall meet the minimum thickness requirements of Standard 90.1 (12007), "Energy Efficient Design of new Buildings" of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) except minimum thickness shall be 1". However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.
- B. Insulation materials furnished and installed hereunder shall be Class A maximum of 25 flame spread, 35 fuel contributed and 50 smoke developed rating and shall meet the fire hazard requirements of each of the following specifications:
 - 1. American Society for Testing of Materials ASTM E84
 - 2. Underwriters' Laboratories, Inc. UL 723
 - 3. National Fire Protection Associations NFPA 255
- C. Calcium silicate products shall include a visual identification system to permit positive field determination of their asbestos-free characteristic.

1.6 QUALITY ASSURANCE

- A. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- B. If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 PRODUCTS

2.1 PIPE INSULATION ON INDOOR SYSTEMS

- A. Molded pipe insulation shall be manufactured to meet ASTM C585 for sizes required in the particular system.
 - B. Molded fibrous glass pipe insulation shall comply with the requirements of ASTM C547. Heavy density Fiberglas pipe insulation with factory applied all-service jacket (ASJ) and Doublesure* two-component adhesive closure system, or Fiberglas Pipe and Tank Insulation, heavy density fiberglass insulation with end grain adhered to ASJ all service jacket. Joints shall be sealed by butt strips having a two-component sealing system or by applying staples and pressure sensitive tape. When self-sealing lap systems are used, sufficient thickness of insulation shall be used to maintain the outer surface temperature of the operating system below +150°F. Manufacturer's data regarding thickness constraints in relation to operating temperature shall be followed. When multiple layers are required, all inner layer(s) shall beunjacketed.
 - C. Fittings and valves shall be insulated with preformed fiberglass fittings, fabricated sections of fiberglass pipe insulation, fiberglass pipe and tank insulation, fiberglass blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish shall match that used on straight sections.
 - D. Flanges, couplings, chilled water pump impeller housings, valve bonnets etc, shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with sections of insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with a suitable vapor resistant mastic.
 - E. On cold systems, vapor barrier performance is extremely important. Particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. Valve stems shall be sealed with caulking to allow free movement of the stem but provide a seal against moisture incursion. All penetrations of the ASJ and exposed ends of insulation shall be sealed with vapor barrier mastic.
 - F. On hot systems where fittings are to be left exposed, insulation ends should be beveled away from bolts for easy access.
 - G. All insulated, exposed piping inside the building within 8'-0" above the floor shall be additionally jacketed with a multi-ply, fabric reinforced, self adhesive insulation cladding material with a vapor barrier and a thickness of 0.015". Jacketing system shall be Venture Clad Plus #1579CW-E or equal.
- 2.2 REFRIGERANT PIPING AND COOLING COIL DRAIN WITH INSTALLATION TEMPERATURE ABOVE 40°F
- H. Insulate piping with ¾" Armstrong Armaflex type AP insulation. Insulation shall be flexible elastomeric thermal insulation, black in color, flame-spread rating of 25 or less and a smoke developed rating of 50 or less as tested by ASTM E84-91A "Method of Test Surface Burning Characteristics of Building Materials".
 - I. Fitting elbow covers shall be fabricated from miter-cut tabular form. In all cases, butt joints and seams are to be sealed with Armstrong 520 adhesive. 520 adhesive is a

contact adhesive; therefore, in all cases, both surfaces to be joined are to be coated with adhesive with installation temperature above 40°F.

- J. Where piping is located outdoors, cover Armaflex insulation with PVC jacketing installed with a glued application.

2.3 SUPPORT FOR PIPE WITH INSULATION

- K. All piping shall be supported in such a manner that neither the insulation nor the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing shall be such that butt joints may be made outside the hanger.
 - 1. On all size piping of cold systems, the pipe hanger saddles shall be separated away from the pipe by utilizing inserts. The vapor barrier shall be continuous, including material covered by the hanger saddle.
 - 2. On warm water piping systems 3" in diameter or less, insulated with Fiberglas insulation, may be supported by placing saddles of the proper length and spacing, as designated in Owens-Corning Pub. 1-IN-12534, under the insulation.
 - 3. For hot or cold piping systems larger than 3" in diameter, Owens-Corning Calcium Silicate pipe insulation shall be used for high density inserts. Piping saddles for piping larger than 3" shall not be in contact with the piping.
 - 4. Owens-Corning Calcium Silicate pipe insulation may be used to support the entire weight of the piping system provided the hanger saddle is designed so the maximum compressive load does not exceed 100 psi.
 - 5. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
 - 6. Thermal expansion and contraction of the piping and insulation system can generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of the insulation are being used.
 - 7. On vertical runs, insulation support rings shall be used.

2.4 ACCESSORY MATERIALS

- L. Accessory materials installed as part of insulation work under this section shall include (but not be limited to):
 - 1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.
 - 2. Field-applied jacketing materials - Sheet metal, plastic, canvas, fiberglass cloth, insulating cement; PVC fitting covers.

3. Support materials - Hanger straps, hanger rods, saddles.

- M. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards".

2.5 INSULATION THICKNESSES

- N. Fittings, including valves, flanges, unions, etc. shall be insulated with the same thickness as the required pipe insulation and covered with PVC fitting cover as specified.
- O. Pipe insulation thickness shall be as follows unless noted otherwise on drawings:

<u>Piping System</u>	<u>Pipe Size</u>	<u>Insulation Thickness</u>	<u>Insulation Conductivity BTU-in H-FT²-F</u>
Domestic cold water	All sizes	1"	0.28
Horizontal rain conductor piping	All sizes	1"	0.28
Horizontal and vertical overflow rain water conductors	All sizes	1"	0.28
Underside of roof drains	All sizes	1"	0.28
Domestic hot water and hot water return (140°F and under)	Up thru 1¼" 1½" and larger	1" 1½"	0.28
Domestic hot water and Hot water return (140°F to 200°F)	Up to 1¼" 1½" and larger	1 ½" 2"	0.28

PART 3 EXECUTION

3.1 SITE INSPECTION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments that all materials and accessories to be installed

on the project may comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

- A. Ensure that all pipe and fitting surfaces over which insulation is to be installed are clean and dry.
- B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation. All damaged insulation installed will be removed and replaced by the Contractor at no extra cost to the Owner.
- C. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.

3.3 INSTALLATION

A. General

- 1. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.
- 2. Install insulation on piping subsequent to installation of heat tracing, painting, testing, and acceptance tests.
- 3. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit overall piping surfaces.
- 4. Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tears or other damage. All staples used on cold pipe insulation shall be coated with suitable sealant to maintain vapor barrier integrity.

B. Fittings

- 1. Cover valves, fittings, and similar items in each piping system using one of the following:
 - a. Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
 - b. Insulation cement equal in thickness to the adjoining insulation.
 - c. PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

C. Penetrations

1. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

D. Joints

1. Butt pipe insulation against hanger inserts. For hot pipes, apply 3" wide vapor barrier tape or band over butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints, and seal joints with 3" wide vapor barrier tape or band.
2. All pipe insulation ends shall be tapered and sealed, regardless of service.

3.4 FIELD QUALITY ASSURANCE

- A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.5 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

3.6 SAFETY PRECAUTIONS

- A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.
- B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.7 ASBESTOS INSULATION

- A. Any existing asbestos insulation on existing piping, valves, equipment, etc. where tie-ins are required, shall be removed by the Owner at Owner's expense. The contractor and Architect/Engineer shall not be responsible for any cost or work involved with removal or encapsulation of asbestos insulation.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sanitary and storm piping system.
- B. Domestic water piping system
- C. Natural gas piping system.
- D. Valves.

1.2 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. ANSI B31.1 - Power Piping.
- B. ANSI B31.2 - Fuel Gas Piping.
- C. ANSI B31.4 - Liquid Petroleum Transportation Piping Systems.
- D. ANSI B31.9 - Building Service Piping.
- E. ASME - Boiler and Pressure Vessel Code.
- F. ASME Sec. 9 - Welding and Brazing Qualifications.
- G. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- H. ASME B16.3 - Malleable Iron Threaded Fittings.
- I. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.
- J. ASME B16.18 - Cast Bronze Solder-Joint Pressure Fittings.
- K. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
- L. ASME B16.23 - Cast Copper Alloy Solder-Joint Drainage Fittings - DWV.
- M. ASME B16.26 - Cast Bronze Fittings for Flared Copper Tubes.
- N. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

- O. ASTM A47 - Ferritic Malleable Iron Castings.
- P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded.
- Q. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- R. ASTM A106 - Carbon Steel Seamless Pipe.
- S. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- T. ASTM A536 – Ductile Iron Castings.
- U. ASTM B32 - Solder Metal.
- V. ASTM B42 - Seamless Copper Pipe.
- W. ASTM B43 - Seamless Red Brass Pipe.
- X. ASTM B75 - Seamless Copper Tube.
- Y. ASTM B88 - Seamless Copper Water Tube.
- Z. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube.
- AA. ASTM B302 - Threadless Copper Pipe (TP).
- BB. ASTM B306 - Copper Drainage Tube (DWV).
- CC. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- DD. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
- EE. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- FF. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- GG. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
- HH. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- II. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
- JJ. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- KK. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

- LL. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
- MM. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- NN. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping.
- OO. ASTM D2683 - Socket-Type Polyethylene Fillings for Outside Diameter-Controlled Polyethylene Pipe.
- PP. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- QQ. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- RR. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.
- SS. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- TT. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- UU. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- VV. ASTM D3309 - Polybutylene (PB) Plastic Hot Water Distribution System.
- WW. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- XX. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- YY. ASTM F891, Schedule 40 Cellular Core PVC-DWV Pipe.
- ZZ. AWS A5.8 - Brazing Filler Metal.
- AAA. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- BBB. AWWA C110 - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
- CCC. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.
- DDD. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- EEE. AWWA C606 – Grooved and Shouldered Joints.

FFF. AWWA C651 - Disinfecting Water Mains.

GGG. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

HHH. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

III. CAN-3 B281 - Aluminum Drain, Waste, and Vent Pipe and Components.

JJJ. NCPWB - Procedure Specifications for Pipe Welding.

KKK. NFPA 54 - National Fuel Gas Code.

LLL. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases.

1.3 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME Sec 9.
- D. 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.
- E. All castings used for coupling housings, fittings, valve bodies, etc. shall be date stamped for quality assurance and traceability.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 SANITARY AND STORM SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING (Must be approved by governing authorities)

- A. Piping up thru 8": Cast iron ASTM A74 service weight with cast iron fittings ASTM C564 neoprene gasket system joints.
 - B. Piping 10" and above: Reinforced concrete pipe with ASTM C-76 Class III specification when piping is located below a paved surface. All other pipe shall be reinforced concrete pipe with ASTM C-76 Class II specification. Joints shall be bell and spigot pattern with "Tylex" gasket material on sanitary piping or cemented joints with "Dewitt" No. 10 caulking around compound on storm piping. Joints shall conform to ASTM V-443.
 - C. Schedule 40 PVC Pipe: ASTM D2729 and ASTM F891 DWV non-pressure cellular core.
 - 1. Fittings: PVC
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - D. Dual wall corrugated polyethylene pipe may be used for storm when approved in writing by the Engineer, pipe sizes thru 10" shall meet AASHTO M252S, pipe sizes 12" thru 36" shall meet AASHTO M294S. Corrugated pipe shall have smooth inner liner. Acceptable manufacturers shall be Hancor or ADS.
- 2.2 SANITARY, STORM AND VENT SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING (Must be approved by governing authorities)
- A. Gravity Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
 - B. Gravity Cast Iron Pipe: CISPI 301, hubless, service weight
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C564, neoprene gasket system.
 - C. Gravity Schedule 40 PVC Pipe: ASTM D2729 and ASTM F891 DWV non-pressure cellular core.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - D. Gravity 10" and larger. Schedule 40 PVC gravity sewer pipe with integral bell and spigot joints.
 - 1. Fittings: PVC
 - 2. Joints: ASTM D3212 flexible elastomeric seals.
 - E. Forced PVC Pipe:
 - 1. 4" and Larger - ASTM D2241, DR18-Class 150 AWWA C900.
 - 2. Fittings: ASTM D2466 PVC
 - 3. Joints: ASTM D3139, integral bell and gasket seal installed with concrete thrust block or ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- 2.3 SANITARY, STORM AND VENT PIPING, ABOVE GRADE (Must be approved by governing authorities)

- A. Gravity Cast Iron Pipe: ASTM A74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C564, hub and spigot, neoprene gasket system.
 - B. Gravity Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
 - C. Gravity Steel Pipe: ASTM A53 Schedule 40, galvanized.
 - 1. Cast Iron Fittings: ASME B16.1, flanges and fittings; ASME B16.4, screwed fittings.
 - 2. Malleable Iron Fittings: ASME B16.3, screwed type. ASTM A47.
 - 3. Ductile Iron Fittings: Grooved end, ASTM A536.
 - 4. Mechanical Grooved Couplings: Ductile iron, galvanized. (as specified for Forced Drains)
 - D. PVC Pipe: ASTM D2729 (when approved by the Architect/Engineer).
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - E. CPVC Pipe: ASTM D2846 (When approved by the Architect/Engineer).
 - 1. Fittings: ASTM D2846, CPVC
 - 2. Joints: ASTM D2846, solvent weld with ASTM F493 solvent cement.
 - F. Forced larger than 3": Steel Pipe: ASTM A53, Schedule 40, galvanized.
 - 1. Fittings: Galvanized steel.
 - 2. Joints: Grooved mechanical couplings.
 - 3. IPS Grooved Piping System.
 - a. Victaulic mechanical pipe couplings, fitting, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer and shall conform to local code approval and/or as listed by ANSI B31.1, B31.9, ASME UL/FM IAPMO or BOC. Grooved end product manufacturer to be ISO-9001 certified.
 - b. Roll or cut grooved ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends shall be grooved in accordance with manufacturer's current listed standards conforming to ANSI/AWWA C-606.
 - c. Mechanical couplings shall be Victaulic style 107H "Installation-Ready" or approved manufacturer, rigid coupling. Victaulic style 177 "Installation-Ready", and style 77 or 75 or equal coupling shall be used where system flexibility is desired at pumps and other mechanical equipment to reduce noise and vibration. Noise and vibration reduction is achieved by installing (3) style 77 or 75 or equal flexible couplings near the vibration source. Couplings shall be of cast ductile iron conforming to ASTM A536, grade 65-45-12.
- 2.4 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING (Must be approved by governing authorities)

- A. Ductile Iron Pipe: ANSI/AWWA C151/A21.51 rated 350 psi with Class 350 fittings.
 - 1. ANSI thickness Class 50 minimum, nominal pipe wall thickness .27" minimum, rated 350 psi at laying condition Type 1.
 - 2. Cement lined as per AWWA C104 (ANSI A21.4)
 - 3. Pipe Joints: Push on, ANSI/AWWA C1533/A21.53, with Tyton gaskets.
 - 4. Fitting Joints: Mechanical, compact, ANSI/AWWA C153/A21.53, with stainless steel or Corten anti-rotation bolts and sacrificial zinc anode cap on each bolt.
 - 5. Coating: Exterior of pipe and fittings, asphaltic coating as per ANSI/AWWA.
 - 6. Polyethylene encasement as per ANSI/AWWA C105/A21.5.
 - 7. Concrete thrust blocks, installation, etc. as per published engineering and construction standards of Michigan Department of Transportation and local codes.
 - 8. All material and installation shall be in accordance with manufacturer's recommendations.
 - B. Copper Tubing: 2" and smaller - ASTM B88, Type K soft temper.
 - 1. Fittings: ASME B16.18 cast bronze or ASME B16.22 wrought copper and bronze.
 - 2. Joints: AWS A5.8, BCuP silver braze if allowed by code, otherwise ASTM B32 solder, lead free Grade 95-5 tin-antimony or tin-silver, with melting range of 430 to 535 degrees F.
 - C. Polyethylene Pipe 1½" or smaller
 - 1. Pipe - Polyethylene (PE) flexible plastic, ASTM D2239 rated 160 psi minimum.
 - 2. Fittings - PE barbed insert fittings.
 - 3. Joints - Stainless steel clamps over barbed insert fittings.
 - D. PVC Pipe:
 - 1. 2½" and 3" - ASTM D2241, SDR 21 - Class 200 AWWA C900.
 - 2. 4" and Larger - ASTM D2241, DR18-Class 150 AWWA C900.
 - 3. Fittings: ASTM D2466, PVC
 - 4. Joints: ASTM D3139, integral bell and gasket seal installed with concrete thrust block or ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- 2.5 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING (Must be approved by governing authorities)
- A. Ductile Iron Pipe: ANSI/AWWA C151/A21.51 rated 350 psi. with Class 350 fittings.
 - 1. ANSI thickness Class 50 minimum, nominal pipe wall thickness .27" minimum, rated 350 psi at laying condition Type 1.
 - 2. Cement lined as per AWWA C104 (ANSI A21.4)
 - 3. Pipe Joints: Push on, ANSI/AWWA C1533/A21.53, with Tyton gaskets.
 - 4. Fitting Joints: Mechanical, compact, ANSI/AWWA C153/A21.53, with stainless steel or Corten anti-rotation bolts and sacrificial zinc anode cap on each bolt.
 - 5. Coating: Exterior of pipe and fittings, asphaltic coating as per ANSI/AWWA.

6. Polyethylene encasement as per ANSI/AWWA C105/A21.5.
 7. Concrete thrust blocks, installation, etc. as per published engineering and construction standards of Michigan Department of Transportation and local codes.
 8. All material and installation shall be in accordance with manufacturers recommendations.
- B. Copper Tubing: 2" and smaller - ASTM B88, Type K, soft temper.
1. Fittings: ASME B16.18 cast bronze or ASME B16.22 wrought copper and bronze.
 2. Joints: AWS A5.8, BCuP silver braze.
 3. No joints shall be located under floor unless standard pipe lengths are not long enough for the entire length of bury, then joints shall be kept to a minimum.
- C. PVC Pipe
1. 3" - ASTM D2241, SDR 21- Class 200 AWWA C900.
 2. 4" thru 12" - ASTM D2241, DR18 - Class 150, DR18 - AWWA C900.
 3. Fittings ASTM D2466, PVC.
 4. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- 2.6 DOMESTIC WATER PIPING, ABOVE GRADE INSIDE BUILDING (Must be approved by governing authorities)
- A. Domestic water piping 6" and smaller shall be: Copper tubing: ASTM B88, Type L, hard drawn, seamless.
1. Fittings: ASME B16.18 cast bronze tee tap or ASME B16.22 wrought copper and bronze.
 2. Fittings 1-1/2" and smaller: ASME B16.18 cast bronze or ASME B16.22 wrought copper, with 301 stainless steel internal components, EPDM seals, and push-to-connect ends. Victaulic Permalynx.
 3. Joints: ASTM B32, solder, lead free Grade 95-A tin - antimony or tin and silver with melting range 430 to 535 degrees F or AWS A5BcuP silver braze.
 4. Fittings 2" and smaller: At the Contractor's option, Schedule 10S stainless steel pipe with Vic-Press 304 fittings and couplings may be used in lieu of soldered copper. The seal material shall be UL classified in accordance with ANSI/NSF61 for Potable Water service.
 5. Joints 2" thru 8" may be mechanical pipe couplings of a bolted type with a central cavity design pressure-responsive gasket along with grooved end copper or bronze fittings as available, as manufactured by Victaulic.
 - a. Copper Tube, ASTM B-88 (Type K or L) - Roll grooved only, at copper-tube dimensions. (Flaring to accommodate alternate sized couplings is not permitted).
 - b. Mechanical Couplings - Shall be Victaulic Style 607H "Installation-Ready" rigid couplings for copper consisting of a ductile iron cast housing, with offsetting angle-pattern bolt pads, a synthetic rubber gasket of a central cavity pressure-responsive design, with ASTM A449 plated nuts and bolts to secure unit together.
 - c. Coupling Housings - Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12), with a copper colored enamel paint coating.

- d. Gaskets - Shall be molded of synthetic rubber in a Flush-Seal configuration conforming to the copper tube size (CTS) outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000. Reference shall always be made to the latest published Selection Guide for Gaskets for proper gasket selection for the intended service.
 - e. Water Service - Gasket supplied for water services from -30°F to +230°F Grade "E" EPDM compound molded of materials conforming to ASTM D-2000, designation 2CA615A25B24F17Z, recommended for hot water service within the specified temperature range, plus a variety of dilute acids, oil-free air, and many chemical services. Not recommended for petroleum services.
 - 1) Gaskets supplied with Style 607H couplings shall be grade EHP for water services from -30°F to +250°F.
 - 2) Gaskets shall be UL classified in accordance with ANSI/NSF61 for Potable Water service.
 - 3) Meets the low lead requirements of NSF-372.
 - f. Flange Adapters - Shall be Victaulic Style 641 Vic-Flange or equal adapters 2"-6", ductile iron ASTM A-536, engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer to supply standard flange bolts. Flange casting shall have a corresponding gasket.
 - g. Fittings - Fittings shall be full flow (smooth turn elbows) copper fittings conforming with ASME B16.22 or cast bronze to ASME B16.18; with grooves designed to accept grooved end couplings at copper-tube dimensions. (Flaring to accommodate alternate sized couplings is not permitted). Victaulic Copper-Connection.
- B. Domestic water piping larger than 6" shall be: Steel pipe: ASTM A53, Schedule 40, galvanized.
- 1. Fittings: Galvanized steel.
 - 2. Joints: Grooved mechanical couplings.
 - 3. IPS Grooved Piping System
 - a. Victaulic mechanical pipe couplings, fitting, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer and shall conform to local code approval and/or as listed by ANSI B31.1, B 31.9, ASME, UL/FM IAPMO or BOC. Grooved end product manufacturer to be ISO-9001 certified.
 - b. Roll or cut grooved ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends shall be grooved in accordance with manufacturer's current listed standards conforming to ANSI/AWWA C-606.
 - c. Mechanical couplings shall be Victaulic style 107H "Installation Ready" or 07 (zero-flex) or equal, rigid coupling or style HP-70 or equal rigid coupling for high pressure service. Victaulic style 177 "Installation Ready" and style 77 or 75 or equal coupling shall be used where system flexibility is desired at pumps and other mechanical equipment to reduce noise and vibration. Noise and vibration reduction is achieved by installing (3) style 77 or 75 or equal flexible couplings near the vibration

source. Couplings shall be of cast ductile iron conforming to ASTM A536, grade 65-45-12.

- d. Mechanical reducing couplings shall be Victaulic style 750 or equal for pipe runs for reduction on pipe sizes 4" thru 8".
- e. Meets the low lead requirements of NSF-372.

2.7 NATURAL GAS PIPING BURIED (Must be approved by governing authorities and local gas utility company)

A. Approval must be given in writing by the local gas company for type of material to be used and the proposed installation method

B. Polyethylene Pipe: ASTM D2513, SDR 11.5.

- 1. Joints and Fittings: Plastic pipe and fittings shall be joined in accordance with manufacturer's instructions. Piping shall be allowed to be joined by methods of heat fusion, or mechanical fittings designed for pipe made to ASTM D 2513 Standards.
 - a. Heat fusion joints shall be made in accordance with manufacturer's recommendations and shall be made by certified personnel in accordance with qualified procedures proven to make gas tight joints as strong as the pipe or tubing being joined.
 - b. Mechanical joints shall be compatible with the plastic piping and gas in the system. A stiffener should be inserted when using OD compression type fittings. The stiffener should be sized specifically for the pipe being installed and should equal the insertion depth of the pipe. Split tubular stiffeners shall not be used.
- 2. Continuous insulated No. 14 copper tracer wire shall be installed with and attached to underground non-metallic gas piping and shall terminate above grade at each end.
- 3. Install polyethylene pipe a minimum of 24" below grade, backfill with clean yellow sand to 6" below grade, and install yellow plastic warning tape 6" below grade above the pipe.
- 4. Polyethylene pipe entering or emerging from the ground at locations exterior from the building shall be additionally protected by encasing with ASTM A53, Schedule 40 black steel pipe to a height of, if practical, 18" below to 6" above the ground.
- 5. Piping penetrating below grade through a foundation or basement wall shall be encased with steel, wrought iron, PVC or ABS Schedule 40 piping. The circular space behind the piping and the sleeve shall be sealed.

2.8 NATURAL GAS PIPING, ABOVE GRADE INSIDE OF BUILDING OR OUTDOORS EXPOSED

A. Steel Pipe: ASTM A53, Schedule 40 black.

- 1. Fittings: ASME B16.3, malleable iron or ASTM A234, forged steel welding type.
- 2. Joints: NFPA 54, threaded or welded to ANSI B31.1, ANSI B31.2, ANSI B31.9, ASME Sec. 9.
- 3. If both ends of the pipe sleeve within the same building terminate indoors, the pipe sleeve shall not be sealed or vented.

4. If one end of the pipe sleeve terminates outdoors and the other terminates indoors, the pipe sleeve shall be sealed and vented.
5. Exterior piping shall be painted with paint for steel pipe and outdoor rated.

2.9 NATURAL GAS PIPING IN CONCEALED LOCATIONS

- A. Steel pipe, ASTM A53, Schedule 80, black iron with welded joints.

1. A concealed location is a location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind removable panels or doors shall not be considered concealed.

2.10 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 22 05 00.

2.11 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 Inches and Under:

1. Ferrous pipe: 150 psig malleable iron threaded unions.
2. Copper tube and pipe: 150 psig bronze unions with soldered joints. (Solder shall be lead free.)

- B. Pipe Size Over 2 Inches:

1. Ferrous pipe: 150 psig forged steel slip-on flanges; 1/16 inch thick preformed neoprene gaskets.
2. Copper tube and pipe: 150 psig slip-on bronze flanges; 1/16 inch thick preformed neoprene gaskets.

- C. Grooved and Shouldered Pipe End Couplings:

1. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)
2. Housing: Two ductile iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion where required; electroplated steel bolts, nuts, and washers conforming with ASTM A449; galvanized for galvanized pipe.
3. Sealing gasket: "C" shape or FlushSeal composition sealing gasket.
4. Gaskets shall be UL classified in accordance with ANSI/NSF-61 for Potable water service.
5. Basis of Design: Victaulic Company, Style 607H (Installation-Ready for Copper Tubing) and Style 107H or 177 (Installation-Ready for Steel Piping).

- D. Dielectric Connections: Dielectric nipples shall be non-conducting for connection of dissimilar materials. Dielectric nipples shall be similar to Victaulic Style 647 or Style 47. A brass adapter dielectric union is not acceptable.

2.12 GATE VALVES

- A. Up to and including 3 Inches: Bronze body, bronze trim, non-rising stem, handwheel, inside screw, single wedge or disc, solder or threaded ends.

- B. Over 3 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged or grooved ends. Basis of Design: Victaulic Series 771V.

2.13 GLOBE VALVES

- A. Up to and including 3 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity (repackable under pressure).
- B. Over 3 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.14 BALL VALVES

- A. Up to and including 3 Inches:
 - 1. Bronze one piece body, stainless steel ball, Teflon seats and stuffing box ring, lever handle and balancing stops, solder or threaded ends with union.
 - 2. Brass two piece body, chrome plated brass ball and stem, PTFE seats and seals, lever handle, and Vic-Press ends. Victaulic Series P589.
- B. Over 1-1/2 Inches: Cast ductile iron steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive handwheel for sizes 10 inches and over, flanged or grooved ends. Basis of Design: Victaulic Series 726.

2.15 PLUG VALVES

- A. Up to and including 3 Inches:
 - 1. Elastomer coated ductile iron disc with integrally cast stem, copper-tube dimensioned grooved ends, lever handle or gear operator. Basis of Design: Victaulic Series 608.
 - 2. Bronze body, bronze tapered lubricated plug, teflon packing, threaded ends.
- B. Over 3 Inches:
 - 1. Cast iron body and lubricated plug, flanged ends.
 - 2. Elastomer coated ductile iron plug with integrally cast stem, ductile iron body and bonnet, welded-in nickel seat, lever handle or gear operator. Basis of Design: Victaulic Series 377.
 - a. For installation on IPS / Steel pipe sizes with Victaulic Style 307 transition coupling.

2.16 BUTTERFLY VALVES

- A. Bronze body
 - 1. Elastomer coated ductile iron disc with integrally cast stem, copper-tube dimensioned grooved ends, lever handle or gear operator. Basis of design: Victaulic Series 608.
 - 2. Stainless steel disc, resilient replaceable seat, threaded ends, extended neck, 10 position lever handle.
- B. Cast or ductile iron body, chrome plated ductile iron disc, resilient replaceable pressure responsive EPDM seat, wafer or lug ends or grooved ends if Victaulic

grooved fittings are used, with extended neck and 10 position lever handle. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating). Sizes 6" and larger furnish gear drive handwheel. Basis of Design: Victaulic MasterSeal™.

2.17 FLOW CONTROL VALVES

- A. Construction: DZR brass (Ametal) or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
 - 1. Body material shall be ISO 6509 compliant.
- B. Calibration: Control flow within 3.5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control.
- C. Manual (Multiple Turn Balancing Valves): Victaulic Series 786/787/78K circuit balancing valve.
- D. If called for on drawings, furnish Victaulic or Griswold flow control valve. Flow control valve shall automatically control flow rates with $\pm 5\%$ accuracy. Valve control mechanism shall consist of a stainless steel cartridge with a ported cup and coil/helical spring to avoid corrosion. Four operating ranges shall be available with minimum range requiring less than 2 psig to actuate the mechanism. Manufacturer shall provide independent laboratory tests verifying accuracy and performance. Griswold flow control valve shall have a 5 year warrantee to guarantee all materials and workmanship. See drawings for flow rate of valve.

2.18 SWING CHECK VALVES

- A. Up to and including 3 Inches: Bronze swing disc, solder or screwed ends.
- B. Over 3 Inches: Iron body, stainless steel or bronze trim, swing disc, renewable disc and seat, grooved or flanged ends. Basis of Design: Victaulic Series 712.

2.19 SPRING LOADED CHECK VALVES

- A. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, or flanged ends.
- B. Ductile iron body, stainless steel spring and shaft aluminum-bronze disc with elastomer seal or elastomer coated ductile iron disc with welded-in nickel seat, grooved ends. Basis of Design: Victaulic Series 716.

2.20 WATER PRESSURE REDUCING VALVES

- A. Up thru 3 Inches: Bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, double union ends.
- B. Over 3 Inches: Cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

- C. Valve shall be as manufactured by Bell and Gossett.

2.21 RELIEF VALVES

- A. Furnish and install as shown on plans a diaphragm-assist operated bronze body ASME rated and nameplated safety relief valve with fail-safe disc to assure normal operation under emergency conditions. The valve shall have a low blowdown differential and shall be designed to relief system pressure in excess of the operating pressure specified for the system, within the maximum operating limitations of the valve. The ASME safety relief valve shall be engineered to prevent the system fluid from entering the spring chamber under normal operating conditions. The permanent valve nameplate shall display the BTUH and relief pressure ratings certified by the National Board of Boiler and Pressure Vessel Inspectors. Valve shall be as manufactured by Bell and Gossett.

2.22 STRAINERS

- A. Size 3 inch and Under: Screwed brass body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 4 inch: Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- C. Size 5 inch and Larger: Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.
- D. Grooved-End Strainers: Size 2 inch through 12 inch, 300 psig working pressure, Y-pattern with 1/16 or 1/8 inch stainless steel perforated screen. Victaulic Series 732.

2.23 INSERTS

- A. Inserts: Malleable iron case of steel shell and expansion plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.24 CONCRETE FOR THRUST RESTRAINT AND COLLARS

- A. Concrete: Class A Concrete conforming to Divisions 500 and 700 of the SCDOT Standard Specifications.
 - 1. Compressive strength of 3,000 psi at 28 days.
 - 2. Air entrained.
 - 3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
 - 4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
 - 5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)

3.3 PLUMBING PIPING INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Dielectric nipples for connection of dissimilar materials. A brass adaptor dielectric union is not acceptable.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 1. For water systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer). Where expansion loops are required, use Victaulic Style 77 couplings on the loops.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Establish elevations of buried piping outside the building to ensure not less than 4'-0" of cover for sewers and not less than 5'-6" of cover for domestic water piping.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to weld.
- K. Provide support for utility meters in accordance with requirements of utility companies.

- L. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
- M. Underground sewers shall be a minimum of 3" in diameter. Sewers located within building shall have a minimum slope of 1/4" per foot for piping 3" and smaller and a minimum slope of 1/8" per foot for piping 4" and larger.
- N. All junctions of drainage piping shall be made with combination "Y" and 1/8 bend fittings.
- O. Install bell and spigot pipe with bell end upstream.
- P. Terminate plumbing vents 12" minimum above roof. Furnish and install weather cap on top of all vent pipes.
- Q. Install valves with stems upright or horizontal, not inverted.
- R. Solder or "sweat" joints shall be used for all copper and brass fittings, valves and tubing, using the soldering flux and methods recommended by the manufacturer of the tubing and fittings. Solder shall be silver solder for buried piping. No lead solder shall be used on any potable water piping.
- S. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- T. Equipment using gas and related piping shall be installed in compliance with NFPA 54 and 58, as applicable.
- U. Install ductile iron pipe and fittings in accordance with AWWA C600 and manufacturer's instructions.
- V. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- W. Maintain minimum 10-foot horizontal separation and 18 inch vertical separation of water main from sewer piping or as required by local code.

3.4 PLUMBING PIPING APPLICATION

- A. Use grooved mechanical couplings and fasteners in accessible locations, risers and pipe chases with Architect/Engineer's approval.
 - 1. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following

best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

- B. Install unions downstream of valves and at equipment or apparatus connections. Unions are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points).
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers. All branch piping take-offs from mains, risers, or branch piping shall have valves installed to allow isolation of branch piping.
- E. Install globe, ball, or butterfly valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.
- G. Provide plug valves in gas systems for shut-off service. Provide removable or fixed handle for each plug valve.
- H. Provide flow controls in water recirculating systems where indicated.

3.5 INSTALLATION OF INSERTS

- A. Install in accordance with manufacturer's instructions.
- B. Provide inserts for placement in concrete formwork.
- C. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- D. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- E. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- F. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.6 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1½ inch minimum vertical adjustment.

- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat and finish paint exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed. Hangers and supports located in mechanical spaces are considered exposed.

3.7 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to minimum 1/8 inch per foot for piping 4" and larger, 1/4" per foot for piping 3" and smaller. Maintain gradients.
- B. Slope water piping and arrange to drain at low points.

3.8 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing. Contractor shall pay all fees, cost, etc. to local authorities for tap-ins, inspections, etc. as required.
- B. Provide new water service complete with reduced pressure backflow preventer, double check valve assembly or water meter with by-pass valves as required by the local authorities.
- C. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
- D. Contractor shall pay all fees, costs, etc. to local authorities for tap-ins, inspections, etc. as required.
- E. Provide new gas service complete with gas meter and regulators. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment. Gas company is responsible for installation of gas service and meter. Contractor shall be responsible for all coordination, etc. Contractor shall inform the gas company of gas load for service for the building and meter size by

the gas company. Owner shall pay all gas company charges for gas service directly to the gas company.

3.9 NATURAL GAS PIPING

- A. Natural gas piping located outdoors shall be prime painted and finish painted with rust prohibitor paint that includes zinc. Color shall be selected by the Architect.
- B. Natural gas piping supports shall occur on 8'-0" centers and at changes in direction.
- C. Natural gas piping installed outdoors on the roof shall be supported at a minimum of 3½" above roof level.
- D. Roof supports shall be a manufactured support similar to PHP-SS8 or equal by Miro.

3.10 POLYETHYLENE ENCASEMENT

- A. Encase Ductile Iron piping in polyethylene where indicated on drawings to prevent contact with surrounding backfill material.
- B. Install in accordance with AWWA C105, Method A.
- C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

3.11 CONCRETE THRUST RESTRAINT

- A. Provide valves, tees, bends, caps, plugs and dead ends with concrete thrust blocks as indicated on drawings.
- B. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
- C. Do not encase fitting joints and flanges.

END OF SECTION

MAI: 2024-2701

SECTION 23 05 00

HVAC REQUIREMENTS

PART 1 GENERAL

1.1 RELATED SPECIFICATIONS AND DOCUMENTS

- A. Drawings and related specifications for this project including General and Supplementary Conditions, Division 1, General Requirements, Instructions to Bidders, Addenda's, etc. apply to and are considered a part of Division 23 - Mechanical Work.
- B. Information in this division is intended to clarify or make additions to the requirements set forth in the General Conditions, Supplementary Conditions, and Division I of these specifications. Any conflict between this Division 23 and other sections or divisions of the specifications or drawings shall be brought to the attention of the Architect/Engineer in writing as a request for addendum prior to the bid opening.
- C. Furnish all equipment, materials, articles, items, operations or methods listed, mentioned or scheduled on drawings, these specifications, manufacturer's installation instructions and include all labor, materials, equipment and incidentals necessary for their complete installation and operation.
- D. All information contained in this section applies to all sections within Division 23 as if it was part of each section.

1.2 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are intended to supplement each other and any material or labor called for in one shall be furnished even if not specifically mentioned in both. Any material or labor which is neither shown on the drawings nor listed in this specification, but is normally incurred or required for completion of work shall be furnished. If there is a discrepancy between the drawings and specifications, the more stringent of the two shall be followed.
- B. Drawings are diagrammatic and are intended to show approximate location and general arrangement of systems and equipment. No attempt has been made to show every ell, tee, etc. Drawings shall not be scaled for location of systems, equipment, etc. All dimensions whether given on drawings or scaled shall be verified in field and coordinated with all other trades and existing field conditions. Some ductwork, piping, equipment, etc. locations may require changes in location due to field conditions and coordination with other trades will be made with no additional cost to the Owner. Failure to check will be no reason for additional compensation.
- C. These drawings and the associated specifications are intended to provide complete furnishing, installation and operational HVAC systems as specified. If these drawings and associated specifications have information omitted that would not allow a completely operational system as is the intent of the Engineer, the bidder shall notify the Engineer a minimum one week prior to the bid date to allow for addenda. Once bids have been received, the Contractor shall be responsible

for material, labor, etc., to furnish and install a completely operational mechanical system as is the intent of these drawings and associated specification.

- D. The installation of all systems, equipment, etc., is subject to clarification with submitted shop drawings and field coordination requirements. Equipment outlines shown on drawings or dimensioned on drawings are limiting dimensions. Any equipment that reduces the indicated clearances or exceeds specified or scheduled equipment dimensions shall not be used.
- E. The Architect/Engineer and Owner reserve the right to make minor changes in the location of equipment, piping, ductwork, etc. at the time of rough-in without additional cost to the Owner.
- F. The Mechanical Trades Contractor shall have completed for his portion of work, at least one installation of size and type comparable to this project and has been in satisfactory operation for at least two complete years. The Mechanical Trades Contractor shall also have a developed service department capable of negotiating service contracts with the Owner for systems herein specified.

1.3 AUTOCAD BACKGROUND FILES

- A. The Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$150.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Contractor.

1.4 MANUFACTURER'S SPECIFICATIONS AND CAPACITIES

- A. Some equipment, materials, etc. that are scheduled on the drawings or listed in any addenda may not be specified in this specification. The manufacturer's specification and capacities shall be considered included and part of this specification whether it is specified in this specification or noted or scheduled on the drawings. The contractor shall remove and replace any "substituted" equipment or material that has been installed or is on site, which in the opinion of the Architect/Engineer does not meet the scheduled equipment or materials manufacturer's capacities or specification at no additional cost to the Owner.

1.5 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.6 LOCAL CONDITIONS

- A. Before submitting proposals, each contractor shall examine these specifications and associated drawings, addenda, etc. and shall examine the site of the project. The bidder shall fully investigate the site of this project, investigate coordination of his work with all other trades and existing conditions and completely satisfy himself as to the conditions to which the work is to be performed before submitting his/her bid. No allowances or considerations will be given at a later date for alleged misunderstanding as to the requirements of the work, materials to be furnished, or conditions required by the nature of this project site and coordination by the neglect on the bidder's part to make such an examination and coordination.
- B. Drawings show approximate location of existing services. The mechanical and electrical trades shall check with local utility companies or municipal agencies for exact location of services which they expect to encounter. The Mechanical Trades Contractor shall be responsible for hiring a company such as "Miss Dig" to stake out and locate all utilities in areas of excavation before commencing any work. The Mechanical Trades Contractor shall verify all elevations and locations of existing underground lines which are to be connected into or routed over or under. This verification shall be done prior to beginning work at this project.

1.7 QUALITY ASSURANCE

- A. All work shall be performed in accordance with all local and state codes, laws and regulations applicable to the work for this project. The contractor shall be responsible for all permits and costs for inspections, etc., and for checking with each utility company supplying service to this project and shall determine from them all, any changes in boxes, meters, valves, service, etc., and shall include all cost for inspections, revisions to services, etc. in his bid as required by local agencies, utilities, etc. No extra payment will be made for such items after the contractor submits his bid.
- B. In addition to all applicable Federal, State and local codes, the standards and codes listed below shall apply to all mechanical work. The reference to codes and standards shall be referenced to the latest edition or revision.
 - 1. Air Diffusion Council (ADC)
 - 2. Air Moving and Conditioning Assoc., Inc. (AMCA)
 - 3. American Boiler Manufacturer's Association (ABMA)
 - 4. American Gas Association (AGA)
 - 5. American National Standard Institute (ANSI)
 - 6. American Refrigeration Institute (ARI)

7. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
 8. American Society of Mechanical Engineers (ASME)
 9. American Society for Testing materials (ASTM)
 10. American Welding Society
 11. ANSI code of Pressure Piping and Unified Pressure Vessels
 12. ASME Boiler and Pressure Vessel Code
 13. Institute of Boiler and Radiator Manuf. (IBR)
 14. National Electrical Manufacturer's Association (NEMA)
 15. Sheet Metal & Air Conditioning Contractors National Association (SMACNA)
 16. Standards of the Hydraulic Institute
 17. Underwriters' Laboratories (UL)
 18. Williams-Steiger Occupational Safety & Health Act (OSHA)
- C. In the event of conflict between drawings, codes, standards or specifications, the most stringent requirement shall apply

1.8 SUBMITTALS AND SHOP DRAWINGS

- A. Submit electronic sets of complete shop drawings for all mechanical equipment and materials associated with Division 23 and associated drawings to the Architect/Engineer for review before fabrication of work or ordering of equipment. Shop drawings shall be submitted at the earliest possible time.
- B. Shop drawings shall be first reviewed by the contractor. Inaccurate shop drawings shall be corrected by the contractor to meet specifications and schedules for this project. The contractor shall then initial the shop drawings as having been reviewed before submitting to the Architect/Engineer. Shop drawings shall have, in addition to the mechanical information, the electrical requirements for minimum circuit amperes and maximum fuse size ratings of the equipment.
- C. Drawings which are rejected must be corrected and returned for Architect/ Engineer review before ordering.
- D. Furnish to the job site copies or prints of shop drawings that have been reviewed by the Engineer as soon as possible.
- E. Include a copy of each shop drawing in the Operation and Maintenance Manual.
- F. The checking and reviewing of shop drawings by the Architect/Engineer shall be construed as assisting the contractor and the Architect/Engineer's action does not relieve the contractor from the responsibility for errors or omissions which may exist thereon. The contractor shall be held responsible for errors or omissions that are discovered after approval process and must be made good by the contractor.
- G. The Sheet Metal Contractor, etc. shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer at a minimum \$100.00 for the first file, and \$50.00 for each additional file that may be requested for AutoCAD use.

1.9 PERMITS, INSPECTIONS AND TESTS

- A. The Mechanical Trades Contractor shall take out all permits and arrange for necessary inspections and shall pay all assessments, fees and costs, etc., and make all tests as required by applicable codes. At the completion of the project, the Mechanical Trades Contractor shall furnish certificates of inspection and approval and secure final occupancy permit. Record copies shall be included in the Operation and Maintenance manuals.

1.10 RECORD DRAWINGS

- A. Maintain an up-to-date set of "record" drawings showing actual equipment, piping, duct, etc. installation locations. Exact dimensions from column lines for all concealed work and tie-ins with elevations noted shall be included.
- B. Include a set of reproducible drawings and a set of prints in each Operation and Maintenance Manual.
- C. The Engineer reserves the right to request and be furnished any additional information he deems necessary to be shown on the record drawings.

1.11 OWNER'S INSTRUCTIONS

- A. Upon completion of the project, the contractor shall be responsible for instructing the Owner's operating staff, in the presence of the Architect/Engineer's representative, in the proper operation and maintenance of the mechanical systems and equipment. Include a statement signed by the Owner that instructions have been given for proper operation and maintenance of the mechanical systems and equipment.

1.12 GUARANTEES

- A. Furnish a written guarantee, to the Architect/Engineer, that will make the contractor responsible at his own expense for any imperfections in material and/or workmanship which may develop under ordinary use within a period of one (1) year from final Owner's acceptance of the work.
- B. Furnish all written guarantees from equipment and/or material manufacturers which shall include the operating and performance conditions and capabilities upon which they are based.
- C. Permanent equipment that is used for temporary heat or cooling shall be guaranteed for one (1) year from the date of final acceptance of the project.

1.13 PORTABLE AND DETACHABLE PARTS

- A. Retain all portable and detachable parts of installation such as keys, spare accessories, operating manuals, etc. include in the Operation and Maintenance Manual.

1.14 OPERATION AND MAINTENANCE MANUALS

- A. Furnish to the Architect/Engineer two (2) copies of an approved bound (3 ring binder) book with tabs for sections covering each item of equipment. These notebooks shall include shop drawings, maintenance manuals, operating manuals and parts lists to instruct the Owner on proper operation and use as well as maintenance for each piece of equipment. These books shall also include contractors', subcontractors' and manufacturers' names, telephone numbers and addresses.
- B. Manuals shall also include sequence of operation, control equipment literature, wiring and control diagrams, certificates of guarantees, certificates of inspection, mechanical system test and balancing reports. The contractor shall accumulate and summarize the control and maintenance sequence in a typewritten sheet to be included in the report.
- C. The manuals must be approved by the Architect/Engineer before final payment to the contractor. The Engineer reserves the right to request and be furnished any additional information that he deems necessary to be included in the manuals.

1.15 RESPONSIBILITIES FOR USE OF SUBSTITUTE MATERIALS

- A. Contractor shall notify Architect/Engineer in writing at least ten (10) calendar days before bids are due for approval to use materials and/or equipment other than that which has been specified or scheduled. If substitute materials and/or equipment are approved and used, it will be this contractor's responsibility to guarantee that the items will function as the specified equipment or materials, will in no way alter the design of the structure or system, and will not require any additional mechanical work such as piping, ductwork, etc. Any additional cost required by substitute materials will be the responsibility of the contractor.
- B. It will be the contractor's responsibility, at his own expense, to remove or replace any non-approved equipment or material or any approved equipment or materials not originally specified or scheduled if equipment and materials do not meet with the satisfaction of the Architect/Engineer.
- C. It shall be the Contractor's (Mechanical Trades) responsibility to coordinate and pay for any Electrical Contractor costs due to any changes in substitute materials and/or equipment's power requirements, which differ from that shown on the design documents.
- D. No consideration will be given to requests for substitute materials because of delivery problems unless the contractor can prove that orders were placed as soon as possible after contract was awarded and that delays were not caused by submittal of unscheduled or unspecified (substituted) materials to the Architect/Engineer.

1.16 COST BREAKDOWN AND EQUIPMENT LIST

- A. The successful bidder shall be responsible for submitting a cost breakdown to the Architect/Engineer and Owner within ten (10) calendar days after date of request of the breakdown. During progress of the work, if changes occur which cause additional cost, the price on such items shall be broken down in accordance with the items listed in the breakdown.

- B. The bidders shall be responsible for submitting a complete list of all equipment manufacturers, makes, models, etc. that will be used for this project with their proposal. The equipment list shall be typed on the contractor's letterhead and shall be signed by the authorized officer.

1.17 MATERIALS AND EQUIPMENT

- A. Materials and equipment furnished under this project shall have a minimum warrantee of one (1) year. All materials and equipment shall be new, of first class quality and shall be furnished, delivered, erected, installed and finished in every detail and shall be so selected and arranged as to fit into the building space. All material or equipment that is not specified but necessary for this project shall be subject to the approval of the Architect/Engineer.
- B. Any materials or equipment not specified or scheduled but similar to that which has had prior approval shall be listed as a substitution and noted on the proposal form as such.
- C. The contractor shall include all miscellaneous materials and labor required to completely install and operate the mechanical systems as is intended by these drawings and specification.

1.18 TEMPORARY HEATING OR COOLING OF SPACE/BUILDING DURING CONSTRUCTION

- A. It is not recommended to use HVAC equipment being furnished for the project for temporary heating and cooling of the space/building during construction. If it is necessary to utilize the HVAC equipment for tempering air, filters shall be placed at face of each return diffuser or grille. Mechanical Contractor shall be responsible for removing temporary; filters at each return diffuser, cleaning return air ductwork and installing new filters within the HVAC equipment before space/building is turned over to the Owner.

1.19 SCHEDULE, COORDINATION AND INSTALLATION OF WORK

- A. The contractor shall carry on work in such a manner as to meet the dates as scheduled by the General Contractor and shall work overtime at no expense to the Owner as required to comply with the schedule. This contractor shall schedule all work with Owner and Architect/Engineer and schedule shut down of systems with Owner.
- B. Examine the site and all drawings and specifications and coordinate work with all other trades before commencing work for this project. Arrange work essentially as shown with the exact layout to be made on the job to suit actual conditions. Precise locations of equipment and materials shall be coordinated and shall be the responsibility of this contractor. Should any conflicts in location occur, and necessary deviations from drawings are required as determined by the Architect/Engineer, the contractor shall make necessary adjustments without additional cost to the Owner. Any damage to HVAC equipment due to HVAC equipment operation during construction shall be paid for by the Mechanical Contractor.

- C. All equipment, piping, ductwork, etc. shall be located and/or routed to allow for the most convenient access for servicing.
- D. Arrange for necessary access doors, panels, etc. to allow servicing of equipment, piping, valves, fire dampers, etc. Perform any cutting and patching as required, made necessary by failure to make proper arrangements.
- E. Indicated equipment connections, sizes and locations shall be verified and connected according to manufacturer's shop drawings and installation instructions. Thoroughly investigate the space provided for equipment and connections before ordering equipment. All equipment shall be selected to fit into the space allowed, including connections with adequate space allowed for operation and maintenance.
- F. All work shall be installed in a neat and workmanlike manner, using skilled personnel thoroughly qualified in the trade or duties that they are to perform. Rough work will be rejected.
- G. Coordinate all equipment deliveries and schedules to allow timely installation. Contractor shall separate equipment into sections and reassemble in building if required by the installation at no extra cost to the Owner.
- H. Furnish a superintendent approved by the Architect/Engineer to oversee and coordinate the work to be performed with all other trades.
- I. Coordinate location of pipes, ductwork, etc. with other building components such as structural components (beams, joists, columns, etc.), electrical components (lighting, conduits, etc.) and architectural components (walls, ceilings, floors, pipe chases, roof, etc.).
- J. Before starting work, Contractor shall verify that available space for proposed pipes, ducts, equipment etc. is adequate for the intended purpose and will result in a first class installation. Irregardless of drawings, responsibility for first class operating systems rests with the Contractor.
- K. Arrange for chases, slots, openings, etc. and other building components to allow for mechanical systems installation. Coordinate cutting and patching of these components to accommodate installation. This contractor shall be responsible for accurately locating for the general trades all chases, shafts, etc. and shall be responsible for all cutting and patching if these chases were not accurate or not coordinated in time with the general trades. Coordinate installation of all sleeves in walls, on floors or other structural or architectural components.
- L. Sequence, coordinate and integrate installation of equipment and materials for efficient work flow during the project. Particular attention should be spent on larger pieces of equipment.
- M. Install equipment and materials with provisions for necessary access for service and maintenance. Allow space for removal of all parts that may require replacement or servicing.

- N. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- O. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. When access panels are required, valves and equipment components requiring access shall be located to minimize the number of panels.
- P. Examine the work as it progresses and alert the Architect/Engineer in writing of any instances or obstructions that will prevent this contractor from performing his/her work.

1.20 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. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.21 COOPERATION WITH ARCHITECT/ENGINEER AND OTHERS

- A. Coordinate all aspects of the mechanical system installation with all other trades, existing conditions, etc.
- B. If the bidder believes that changes in design are required to meet intended design capacities and operation or material and/or equipment is obviously omitted from these specifications and drawings, the bidder shall contact the Architect/Engineer in writing at least ten (10) days before bid date. The acceptance of a bid by the Owner shall be binding and shall indicate that the bidder does not require any changes in design nor additional costs in order to meet the design and performance of the mechanical system as indicated in these specifications and drawings.

1.22 WORK INVOLVING OTHER TRADES

- A. Equipment or materials specified in Division 23 may have to be installed by other trades (such as electrical trades or architectural trades) due to code requirements or union jurisdictional requirements. Where this occurs, this contractor shall include all costs required by other trades to complete the work and hire the respective trade to perform this work.

1.23 PERFORMANCE DATA AND ACCESSIBILITY

- A. All performance data specified in this specification or scheduled on drawings shall be considered actual performance of the equipment after installation. The supplier and installer shall be responsible for suitable allowances to adjust equipment to

design capacities when actual operating and installation conditions differ from drawings.

- B. All equipment and materials shall be installed to allow access for servicing and maintenance. Coordinate final location of such equipment and materials that are concealed with required access doors on panels. Allow ample space for replacement or servicing. Extend all grease fittings to an accessible location.

1.24 CUTTING AND PATCHING

- A. Unless noted otherwise, the Mechanical Trades shall be responsible for all cutting, patching and associated work required under Division 23. This work shall be performed by trades normally performing this type of work except drilling of holes shall be done by the contractor requiring same. This includes replacing areas of cutting required by this work with proper reinforcing, termite shielding, materials, finishing, etc. to restore the areas to their original condition, and filling all openings around ducts, piping, etc. with approved fire retardant materials. Regardless, all drilling of holes shall be the responsibility of the Contractor requiring same.
- B. If noted on drawings that the General Trades will be responsible for all cutting and patching, it will be the Mechanical Trades responsibility to notify all General Trades during bidding of all areas requiring cutting and patching. Regardless, all drilling of holes shall be the responsibility of the contractor requiring same.

1.25 WORK IN EXISTING BUILDINGS

- A. Coordinate and schedule all work in existing building with Owner and Architect/Engineer. Systems shall be kept in operation at all times if at all possible. If a system shut-down is required, the contractor shall schedule with the Owner, the time and length of shut-down. A system shall not be shut down without written permission from the Owner.
- B. All existing equipment, piping, ductwork, etc. that is to be removed shall remain the property of the Owner. The contractor shall remove and locate this material that remains the property of the Owner to a location determined by the Owner somewhere on site. If the Owner does not want to maintain possession of the removed material, the contractor shall be responsible for removing material from the site and disposing of this material as necessary to meet all codes and requirements and shall pay all costs as required for any disposal fees, inspections, permits, etc.
- C. All existing piping, equipment, etc. whether shown on drawings or not that is to be removed and/or abandoned and does not remain property of the Owner shall be removed from site.
- D. Any existing piping, valves, mechanical equipment, etc. serving the existing building which are shown or not shown on drawings and are required for systems operation shall remain in use. If these systems require relocation to allow installation of new systems, the contractor shall be responsible for relocating to an Owner and Architect/Engineer approved location. The contractor shall pay all cost for this work and include such cost in his/her bid. (As specified previously,

contractor shall be responsible for examining site and include all cost for work required to complete this project.)

- E. When active services, etc. are encountered in this project, the contractor shall furnish and install bracing, support, etc. as required to protect and keep these services active. (As specified previously, these drawings are diagrammatical. The contractor shall be responsible for verification of all existing services, piping, equipment, etc.).

1.26 ACCESS TO EQUIPMENT, HEATING COILS, VALVES, ETC.

- A. Coordinate access panels with type of construction and furnish access panels in areas that are non-accessible. Access panels shall be furnished by this contractor and installed by the General Contractor. The access panels shall be all approved, UL labeled and fire rated and shall be located and sized to allow access to equipment, heating coils, valves, fire dampers, etc.
- B. Where access panels are required, valves, equipment etc. shall be located as to require the least number of access panels.

1.27 EQUIPMENT GUARDS

- A. All rotating or moving parts of equipment that are located so as to be a hazard shall be fully enclosed or properly guarded as to meet or exceed all regulations and OSHA requirements.

1.28 EQUIPMENT CONNECTIONS

- A. Connections to equipment, plumbing fixtures, etc. shall be made in accordance with shop drawings, rough-in dimensions furnished by the manufacturer, codes, etc. and may vary with connections shown on drawings. The contractor shall be responsible for making connections and number of connectors as per shop drawings, codes, etc. at no additional cost to the Owner.

1.29 ELECTRICAL CONNECTIONS

- A. The Electrical Trades shall be responsible for furnishing and installing all electrical equipment, wiring, etc. required for operation of mechanical equipment unless otherwise noted on the drawings. The Mechanical Trades shall furnish detailed information and wiring diagrams to the Electrical Trades for all equipment specified and/or scheduled for this project. In the event that the Mechanical Trades furnishes an "approved equal" or "alternate" that require changes in the original electrical design, the Mechanical Trades shall pay all costs to the Electrical Trades as required to make satisfactory adjustments. All electrical work shall be done in accordance with the latest edition of the National Electric Code.
- B. See the temperature control or building automation system specification (if applicable) for description of electrical contractor work and Division 23 temperature control work.

1.30 MOTORS, MOTOR STARTERS AND DISCONNECTS

- A. Unless otherwise noted on drawings, motors shall be of constant speed 1750 rpm, new NEMA Design B, 40°C rise, horse power rated, open drip-proof except TEFC in dirty atmosphere, induction type motor with service factor of 1.15 and be of sufficient capacity to continuously operate the apparatus to which it is connected under all conditions of operation without exceeding nameplate ratings.
- B. Motors shall be premium efficiency as calculated using IEEE test method 112B.
- C. Motors ½ Hp. or larger shall be three phase; motors under ½ Hp. shall be 115 volt, 60 cycle, single phase. Before ordering the motors, the contractor shall verify correct motor voltage with the Electrical Trades and field conditions.
- D. The Mechanical Trades shall furnish, for equipment under Division 23, all special switches, disconnects, starters, alternators, etc. as specified or scheduled to be factory furnished and/or factory installed with the equipment including wiring diagrams, etc. whether it is to be factory installed or field wired. All other motor starters, disconnects, etc. not noted as factory furnished shall be furnished and installed by the Electrical Trades.
- E. Starters that are to be factory furnished with equipment shall be of the combination type and shall be as specified under Electrical Trades Division. Furnish overload protection for each phase.
- F. All wiring methods and materials shall meet NEMA, National Electric Code and State of Michigan Code requirements.
- G. All displays on control panels shall be on face of the panels.
- H. Motors having V-belt shall be furnished with base slide rails or other form of adjustment.

1.31 LUBRICATION AND MAINTENANCE

- A. Contractor shall maintain, oil, lubricate, etc. all equipment furnished under Division 23 until final acceptance by the Owner. Protect all bearings and shafts during installation and thoroughly grease the steel shafts to prevent corrosion. The contractor shall be responsible for any and all damage to bearings, shaft, etc. of Division 23 equipment operated or not until final acceptance by the Owner.

1.32 EXCAVATION AND BACKFILLING

- A. Furnish all excavation, backfilling and removal of excess dirt to accomplish installation of Division 23 mechanical work unless otherwise noted on drawings.
- B. All excavation shall be by open cut from the surface. Contractor shall determine whether excavation shall be by machine or by hand except where existing utilities may be located where excavation shall be by hand. Contractor shall be responsible for all damage to existing facilities and services. Excavation shall be to a depth of at least 6" to allow granular bedding below pipe or duct.

- C. If for any reason the work is suspended, the contractor shall properly protect the excavation and leave the areas unobstructed.
- D. Trench width shall allow sufficient width at centerline of pipe to allow at all times a first class construction/installation method but in no case should be less than 12" larger than the nominal pipe or duct size. This shall especially be true in areas that joints must be connected. Joint holes may have to be made with overhanging sides to make installation safe for workmen.
- E. The excavation shall be at all times finished and backfilled to the required grade after completion and approval of work. Not more than 100 feet of trench shall be excavated and open unless written approval is given by the Architect/Engineer.
- F. The subgrade shall be 4" to 6" below the pipe of granular bedding graded and tamped by hand or mechanical means to the exact elevation required at the bottom of the pipe. Granular materials shall be approved fine aggregate meeting MDOT #2NS specifications. This material shall pass a 1/2" sieve but will be retained on a #4 sieve. If poor soil conditions exist which will not give proper support to the pipe, duct or structure, furnish granular fill as required to remedy this situation and give proper support.
- G. Furnish and install properly sloped sheet piled, shored and braced in areas that the soil requires this to maintain a proper excavation and prevent any movement of earth which could in any way damage the work under construction. When removing the sheeting and bracing, special care should be taken to prevent any caving of the sides of the excavation and injury to the completed work or adjacent property.
- H. Take all necessary action to keep trenches and other excavation areas free from water at all times. Use such methods as pumping, ditching, well pointing, etc. to prevent water in trench or excavation. Dewatering of trench shall have constant supervision.
- I. Backfill excavation and trenches with approved granular material around sides of pipe and at least 12 inches above the top of the pipe laid not more than in 6 inch layers that are thoroughly tamped to 95% of its maximum density. There shall be no backfilling by any mechanical means until the granular material has been firmly tamped around the entire pipe to 12 inches above the pipe. All material used for backfilling shall be approved by the Architect/Engineer. Wherever trenching crosses walks or roadways or isolated inside of building, backfill top 6'-0" of trench with sand or bank run gravel in layers not to exceed 6 inches in depth and carefully compact by hand or machine. Do not backfill with frozen materials.
- J. No piping shall be covered until it has been tested, inspected and approved. Upon completion of backfilling, grade shall be restored in indicated elevation and left in reasonable condition for finish grade by others unless otherwise noted on drawings.
- K. Before final acceptance of work, all disturbed streets, drives, curbs, walks, parking areas, etc. shall be paved, graveled or other to as near their original condition as possible. All unused excavated material shall be removed from site if directed by the Architect/Engineer.

1.33 BASES AND SUPPORTS

- A. This contractor shall be responsible for furnishing all equipment pads and supports for equipment and materials required by Division 23 unless otherwise noted on drawings.
- B. All floor mounted mechanical equipment shall have a reinforced concrete pad furnished unless otherwise noted on drawings. The concrete pads shall be tied to the building floor with expansion bolts located maximum of 4'-0" on centers with a minimum of four (4) bolts, set before pouring and concealed within the pad. The Mechanical Trades shall verify exact pad or support size with the equipment manufacturer and shall size pad with adequate area to allow sufficient room for installation of vibration isolators, equipment mounting hardware, etc. Concrete pads shall have a 45 degree bevel at the top edge. The contractor shall verify exact location of concrete pads.
- C. Furnish all steel, hanging material, rods, etc. for suspending equipment off floor unless otherwise noted on drawings for equipment to be furnished under Division 23. This includes all structural steel for supporting between beams.
- D. All support structure shall be of strength to safely withstand all stresses and loads to which they will be subjected and shall distribute load properly over the building area. Supports shall be designed to avoid undue strain to equipment and to avoid interference with piping, pipe connections, service and maintenance clearances, etc.
- E. Where equipment is to be floor mounted and requires legs, this contractor shall furnish and install structural steel members or steel pipe and fittings for legs. Fasten and brace to equipment and furnish flange at base to allow bolting to floor.
- F. Where equipment is to be ceiling or wall mounted, furnish necessary platform, structural steel, hardware, etc. as is most suitable for support of this equipment.
- G. All supports shall be approved by the Architect/Engineer.
- H. All piping, ductwork, etc. shall be suspended from structural steel members utilizing rods and approved hanger devices. Do not use metal deck for support. Beam clamps such as the Grinnell Fig. 260 or approved equal shall be used. Sheet metal "straps" shall not be used in place of rods.
- I. The mechanical trades shall be responsible for furnishing and setting in place all mechanical equipment, roof curbs and piping/duct roof curbs. The general trade shall be responsible for the roof work and associated flashing. The mechanical trade shall furnish and install treated wood base blocking as required to level curb and to match roof insulation thickness. Curb shall be as specified, or if not specified should be similar to Pate or Thy-curb with heavy gauge galvanized steel, insulated and with wood nailer. Height of curb scheduled or specified shall be height required to top of curb above finished roof. If height is not specified or noted, a minimum 12" high above finished roof will be required. (pipe support units shall be at height required). Rooftop units will be shipped knocked down with the

mechanical trade responsible for assembly on site. Roof curb shall mate with unit and provide support and a watertight installation.

1.34 SLEEVES, PLATES AND COLLARS

- A. Furnish all sleeves, plates and collars for piping, ductwork, etc. passing through walls, floor ceilings, foundations, etc. Coordinate with the General Contractor the exact location and size of required openings. No pipe or duct shall pass through a wall, floor ceiling, etc. without a sleeve. This contractor shall be responsible for sleeve locations and securing sleeves before concrete is formed.
- B. Sleeves for steel pipe shall be standard weight black steel pipe. For walls, foundations and ceilings, sleeve shall be kept flush with finished surfaces. For floors, the sleeve shall be set flush with bottom of concrete construction and be extended up ¼" above concrete floor. Sleeves shall be set in place before construction of walls, floors, ceilings, etc.
- C. Sleeves for copper pipe shall be type "M" hard copper tubing installed typical to that of steel pipe sleeves.
- D. Sleeves for piping shall be sized to allow insulation to run continuous through sleeve whenever possible and to allow not less than ¼" all around bare pipe or insulation.
- E. Sleeves for ducts passing through floors shall be 14 gauge black steel for ducts up to 24" maximum dimension, and 12 gauge black steel for ducts 25" and over maximum dimension. Sleeves shall be kept flush with the finished wall surface.
- F. Where insulated piping passes through walls or floor sleeves, furnish 22 gauge galvanized band around insulation of same length as the sleeve length. Band shall fit snugly over insulation and be held in place by steel metal collars all around insulation to cover openings.
- G. All penetration voids shall be sealed smoke tight with non-combustible materials similar to 3M or Hilti firestop systems to maintain the integrity of the fire rated structure. In a non-fire rated assembly, seal all voids with non-hardening sealant.
- H. Where bare piping 2" and smaller pass through wall or floors, furnish polished chrome plated brass escutcheons, split type. Bare piping 2½" and larger that pass through walls or floor, furnish 22 gauge galvanized steel metal collars so as to cover opening.
- I. Where piping penetrates an outside wall, below grade, utilize a mechanical sleeve, similar to link-seal, with stainless steel nuts and bolts on fasteners.

1.35 RIGGING AND HOISTING

- A. Perform all required rigging, hoisting, transportation, moving, etc. of all equipment, materials, etc. to be furnished and/or installed under Division 23 whether furnished by this contractor or by the Owner or other trades.

1.36 STORAGE FACILITY

- A. Furnish and maintain a weatherproof storage facility on the site of adequate size to store miscellaneous equipment and/or materials to prevent exposure to the weather. Location of shed shall be determined by the Owner and Architect/Engineer. The Owner reserves the right to deny storage of materials or equipment in any existing or new buildings.

1.37 PROTECTION FROM DAMAGE

- A. The contractor shall be responsible for all materials, equipment, etc. and all work installed by himself and shall protect it from damage until final acceptance of this project by the Owner.
- B. Furnish all coverings and protection from dirt, dust, rain, storm, heat, traffic, wear, etc. and all possible injury including that by other workmen. Any equipment, workmanship, materials, etc. damaged prior to final acceptance by the Owner of this project shall be properly repaired at no expense to the Owner.
- C. Protect all plumbing fixtures and other equipment from damage by covering or coating. Any dented, scratched, rusted or marred surface finishes will not be accepted.
- D. Protect all equipment, materials, etc. from freezing.

1.38 COMMON PIPE MATERIALS AND INSTALLATION INSTRUCTIONS

- 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. Refer to individual Division 23 piping Sections for special joining materials not listed below.
 - 1. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - a. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - 1) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - 2) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - 3. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
 - 4. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
 - 5. 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.

6. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
7. Solvent Cements for Joining Plastic Piping:
 - a. ABS Piping: ASTM D 2235.
 - b. CPVC Piping: ASTM F 493.
 - c. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - d. PVC to ABS Piping Transition: ASTM D 3138.
8. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

1.39 PIPE HANGERS AND SUPPORTS

- A. Hangers and saddles shall be Modern Pipe Support Corp., Grinnel/Anvil, Autogrip, or M-CO. Inserts shall be of the type to receive a machine bolt head or nut after installation, permit horizontal adjustment, and shall be flush with the surface. For copper pipe with steel hangers, clean and wrap pipe with two layers of plastic insulating tape at point of contact. Roller supports shall be adjustable type with insulated standoff. Rods shall be used for suspended installation. Sheet metal "straps" shall not be used in place of rods.
- B. Hangers for piping with vapor barrier sealed insulation shall be multipurpose pipe saddles fitting over the insulation. Wire or perforated strap iron will not be permitted for pipe supports. Do not support hangers from roof deck. Furnish and install all support steel as required to suspend from structural steel joist or beams. Hangers shall be clevis or split ring type with vertical adjustment and beam clamp similar to Grinnell/Anvil Fig. 260, with maximum spacing per ASHRAE Standards:

Pipe Size	Steel Pipe	Copper Pipe	PVC Pipe	Rod Size
½ to ¾ inch	6 feet	5 feet	4 feet	3/8"
1 inch	7 feet	5 feet	4 feet	3/8"
1 ¼ inch	7 feet	7 feet	4 feet	3/8"
1½ inch	7 feet	7 feet	4 feet	1/2"
2 inch	10 feet	8 feet	4 feet	1/2"
2½ inch	11 feet	9 feet	4 feet	5/8"
3 inch	11 feet	9 feet	4 feet	5/8"
3 ½ inch	13 feet	11 feet	4 feet	5/8"
4 inch	14 feet	12 feet	4 feet	3/4"
5 inch	14 feet	12 feet	4 feet	3/4"
6 inch	14 feet	--	4 feet	3/4"
8 inch	16 feet	--	4 feet	7/8"
10 inch	16 feet	--	4 feet	7/8"
12 inch	20 feet	--	4 feet	1"
14 inch	20 feet	--	4 feet	1¼"
16 inch	20 feet	--	4 feet	1¼"
18 inch	20 feet	--	4 feet	1¼"

- C. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

- D. Hangers for Hot Pipe Sizes $\frac{1}{2}$ to $1\frac{1}{2}$ Inch: Malleable iron, adjustable swivel, split ring.
- E. Hangers for Cold Pipes sizes $\frac{1}{2}$ " to $1\frac{1}{2}$ " and Hot and Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- F. Hangers for Hot Pipe Sizes thru 4 Inches: Carbon steel, adjustable, clevis.
- G. Hangers for Hot Pipe Sizes 5 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- H. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- I. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
- J. Wall Support for Pipe Sizes up thru 3 Inches: Cast iron hook.
- K. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
- L. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
- M. Vertical Support: Steel riser unistrut clamps at high, mid, and low locations.
- N. Floor Support for Cold Pipe all sizes and Hot Pipe Sizes up thru 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- O. Floor Support for Hot Pipe Sizes 5 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- P. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- Q. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- R. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustments, top slot for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

1.40 PIPING, DUCTWORK AND EQUIPMENT SUPPORT

- A. Attachments of mechanical equipment to structural members are the responsibility of the installing trade. Structural members shall not be field cut, welded or otherwise modified without approval of the Architect/Engineer. Attachment to steel joist shall be made at panel points. When routing piping or ductwork perpendicular to joist, a support shall be provided at every steel joist; when parallel to joist, a

support shall be provided at no more than 6' on centers or two panel bays. Structural members shall not be overloaded as a result of attachments. Attachment/equipment loading for all trades resulting in total load greater than an equivalent uniform 5 psf for any member shall be submitted to the Architect/Engineer for review. Mechanical Trades may contact the project Structural Engineer as required for panel point location assistance and welder certification requirements. Electrical Trades are still responsible for design, layout, and fabrication and installation of electrical supports and support attachment methods. Mechanical Trades shall submit attachment methods to the Structural Engineer for review.

- B. Install products in accordance with manufacturer's instructions.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut structural members without permission from Architect/Engineer.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

1.41 PIPING SYSTEMS SHUT OFF VALVES

- A. Shut off valves shall be installed at all branch lines off main piping, or where mains divide/separate to serve different areas, to allow isolation of all branch piping and systems they serve such as air handling units, areas or wings of the building, etc.

1.42 CLEANING AND FINISHING

- A. During construction period, remove all debris, rubbish, tools, equipment, unused materials, etc. as required or requested by the Architect/Engineer. All cost for cleanup and removal will be the responsibility of the contractor.
- B. Upon completion of the project and before final acceptance by the Owner, the entire installation shall be thoroughly cleaned, all rubbish and unused material removed to the satisfaction of the Architect/Engineer. All dust and dirt shall be removed from all equipment, piping, ductwork, etc.
- C. Thoroughly clean all heating units, fans and fan wheels, diffusers and grilles, air handler plenums and air filter frames, etc. using compressed air if necessary.
- D. Finish paint all equipment, materials, piping, etc. as noted on drawings or listed in this specification. Match Owner's existing color scheme. Any Division 23 equipment which has been scratched or damaged shall be finished equal to the original finish.

1.43 DUCTWORK MANUAL BALANCING DAMPERS

- A. All duct branch take off's to diffusers, grilles, regulators, etc. shall have manual balancing dampers installed to allow balancing of outlets.

1.44 EQUIPMENT/SYSTEMS START-UP

- A. Furnish and schedule manufacturer's start-up service for all equipment and systems. These start-up services shall be performed in the presence of, and to the satisfaction of the Owner and Architect/Engineer.

1.45 EQUIPMENT/SYSTEMS SIGN-OFF

- A. The Mechanical Trades shall furnish written sign-offs on all systems stating that the equipment and systems have been checked, tested, started and that their operation has been verified correct through the entire range of operation that can be expected through the seasons.

1.46 SUBSTANTIAL COMPLETION

- A. Contractor shall submit a letter to the Architect/Engineer advising that all work has been completed in accordance with plans and specifications and the project is ready for a final walk-thru.

END OF SECTION

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SECTION 23 05 48

VIBRATION ISOLATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Vibration isolation.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Placement of isolators in floating floor slabs.

1.3 CONCRETE FURNISHED AND INSTALLED BY OTHERS

- A. All concrete shall be furnished and installed by the General Contractor unless otherwise noted on drawings.
- B. This contractor shall be responsible for coordinating all concrete work with the general trades during bidding (includes equipment, pads, etc.).

1.4 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 HP, plus connected piping and ductwork.
- B. Provide minimum static deflection of isolators for equipment as indicated.
 - 1. Basement, Under 20 hp
 - a. Under 400 rpm: 1 inch
 - b. 400 - 600 rpm: 1 inch
 - c. 600 - 800 rpm: 0.5 inch
 - d. 800 - 900 rpm: 0.2 inch
 - e. 1100 - 1500 rpm: 0.14 inch
 - f. Over 1500 rpm: 0.1 inch
 - 2. Basement, Over 20 hp
 - a. Under 400 rpm: 2 inch
 - b. 400 - 600 rpm: 2 inch
 - c. 600 - 800 rpm: 1 inch
 - d. 800 - 900 rpm: 0.5 inch
 - e. 1100 - 1500 rpm: 0.2 inch
 - f. Over 1500 rpm: 0.15 inch
 - 3. Upper Floors, Normal
 - a. Under 400 rpm: 3.5 inch
 - b. 400 - 600 rpm: 3.5 inch
 - c. 600 - 800 rpm: 2 inch
 - d. 800 - 900 rpm: 1 inch
 - e. 1100 - 1500 rpm: 0.5 inch
 - f. Over 1500 rpm: 0.2 inch
 - 4. Upper Floors, Critical

- a. Under 400 rpm: 3.5 inch
 - b. 400 - 600 rpm: 3.5 inch
 - c. 600 - 800 rpm: 3.5 inch
 - d. 800 - 900 rpm: 2 inch
 - e. 1100 - 1500 rpm: 1 inch
 - f. Over 1500 rpm: 0.5 inch
- C. Upper floor locations shall be considered critical unless otherwise indicated.
- D. Use concrete inertia bases for fans having static pressure in excess of 3.5 inch WC or motors in excess of 40 HP, and on base mounted pumps over 10 HP.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Open Spring Isolators:
- 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- B. Restrained Spring Isolators:
- 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 5. Restraint: Provide heavy mounting frame and limit stops.
- C. Closed Spring Isolators:
- 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 - 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- D. Restrained Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
- E. Spring Hanger:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate [neoprene isolation pad meeting requirements for neoprene pad isolators] [rubber hanger with threaded insert].
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- F. Neoprene Pad Isolators:
1. Rubber or neoprene waffle pads.
 - a. 30 durometer.
 - b. Minimum ½ inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs shall not exceed 0.7 times width.
- G. Configuration: ½ inch thick waffle pads bonded each side of ¼ inch thick steel plate.
- H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.
- I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- J. Seismic Snubbers:
1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions. See drawings for types of vibration isolation required.
- B. Install isolation for motor driven equipment.
- C. Bases:
 - 1. Set steel bases for one inch clearance between housekeeping pad and base.
 - 2. Set concrete inertia bases for 2 inch clearance between housekeeping pad and base.
- D. Adjust equipment level.
- E. Install spring hangers without binding.
- F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- H. Provide pairs of horizontal limit springs on fans with more than 6.0 inch static pressure, and on hanger supported, horizontally mounted axial fans.
- I. Support piping connections to isolated equipment resiliently to nearest flexible pipe connector.
- J. Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

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SECTION 23 05 53

HVAC IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe Markers.

1.2 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. ANSI or equal standards for the Identification of Piping Systems.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color. Furnish and install on all mechanical equipment.

2.2 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1½ inch diameter with smooth edges.
- B. Chart: Typewritten letter size list in anodized aluminum frame.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. ¾ to 1¼ inch Outside Diameter of Insulation or Pipe: 8 inch long color field, ½ inch high letters.
 - 2. 1½ to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, ¾ inch high letters.
 - 3. 2½ to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1¼ inch high letters.
 - 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2½ inch high letters.
 - 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3½ inch high letters.
 - 6. Ductwork and Equipment: 2½ inch high letters.

- B. Stencil Paint shall be semi-gloss enamel, colors conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color: Match existing or conform to ANSI/OSHA standards.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 - 1. Yellow - HVAC equipment
 - 2. Red - Fire dampers/smoke dampers
 - 3. Green - Plumbing valves
 - 4. Blue - Heating/cooling valves

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces as required by manufacturer's installations for stencil painting.

3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

- F. Identify each piece of equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify thermostats relating to terminal boxes or valves with nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.
- K. Identify piping, concealed or exposed, with plastic tape pipe markers or stenciled painting. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- M. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- N. Identify access points at the exterior of all fire, smoke, or combination fire/smoke dampers with a permanent label, having letters not less than ½" in height, reading fire damper, smoke damper or fire/smoke damper respectively.

END OF SECTION

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.

1.2 RELATED SECTIONS AND DRAWINGS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. AABC - National Standards for Total System Balance.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 SUBMITTALS

- A. Submit electronic draft copies of report for review prior to final acceptance of Project. Provide electronic final copies for Architect/Engineer review and for inclusion in operating and maintenance manuals.
- B. Provide reports in 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. Binder shall be high quality hard cover type.
- C. Include detailed procedures, agenda, sample report forms and copy of NEBB Project Performance Guaranty prior to commencing system balance.

- D. Test Reports: Indicate data on AABC National Standards for Total System Balance forms or forms approved in writing by Architect/Engineer.

1.5 PROJECT RECORD DOCUMENTS

- A. Record actual locations of flow measuring stations and/or balancing valves and rough setting.

1.6 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance.
- B. Maintain one copy of each document on site.
- C. The final air balance report shall be approved by the Architect/Engineer prior to final payment to the Contractor. The Engineer reserves the right to ask for and be furnished any additional information he deems necessary to be shown on air/water balance report.

1.7 QUALIFICATIONS

- A. Agency: Independent company (not associated with the systems installing contractor) specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience and NEBB certified. The test and balance agency selected by the Contractor shall be approved by the Engineer. The Mechanical Trades shall be responsible for any cost differences between the test and balance agency selected by the Contractor and the test and balance agency approved by the Engineer.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project. Coordinate project schedule with contractor. The Mechanical Trades shall coordinate and schedule the on-site balancing with the Engineer to allow the Engineer the ability to be at the project site during the time of the balancing. If the Engineer is not scheduled to oversee the balance of systems, the Mechanical Trades shall be responsible for rebalancing the system in the presence of the Engineer and be responsible for all costs for such.
- B. The Test and Balance Agency shall schedule/coordinate (through the Mechanical Contractor) with the Temperature Control Contractor. The Temperature Control Contractor should be on site during the air balance to verify proper operation of the system required for the air balance.
- C. Acceptable Test and Balance Contractors.
 - 1. HiTech Test and Balance (Freeland, MI)
 - 2. Absolute Balance Company (South Lyon, MI)
 - 3. Enviro-Aire/Total Balance Company (St Clair Shores, MI)
 - 4. Ener-Tech Testing (Holly, MI)

5. International Test & Balance (Southfield, MI)

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of existing conditions.

3.2 PREPARATION

- A. Provide a review of proposed design drawings and advise appropriate trades about additional balancing devices required to attain design conditions.
- B. Advise Engineer about additional balancing devices required to attain design conditions.
- C. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply, return and exhaust systems.
- B. Air Outlets and Inlets: Adjust to within plus 10 percent and minus 5 percent of design and to Owner's satisfaction. Respond to Owner complaints of unsatisfactory room temperatures by adjusting outlets and/or inlets to more or less air as required.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities. The air balance agency shall be responsible for removing all adjustable motor pulleys and replacing them with fixed motor pulleys after air balancing the system. Include costs for all air systems to be readjusted to required air volumes. Pitot duct mains at supply air and return air ducts at air handling systems and exhaust fans to verify air quantity at units vs. at diffusers and grilles.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices at outlets to regulate air quantities so that outlets do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
- M. Check units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- N. For variable air volume units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.
- O. On VAV boxes, adjust for proper operation.
- P. Advise Mechanical Contractor about additional balancing devices required to attain design conditions.
- Q. Adjust adjustable pitch sheaves to setting as required by actual conditions. If sheave size or type changes are recommended, include the recommendation in the draft copy of the report to allow the Owner to be informed of, and be responsible for, the recommendation for the change.

3.6 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing shall include but not be limited to: Air moving equipment such as exhaust fans, air handlers, return fans, etc.; terminal devices such as grilles and diffusers, variable air volume boxes, etc. See drawings for equipment utilized for this project and submit applicable report forms for this project air and/or water system(s).
- B. Report Forms
 - 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone number of Testing, Adjusting, and Balancing Agency
 - d. Project name

- e. Project location
- f. Project Architect
- g. Project Engineer
- h. Project Contractor
- i. Project altitude
- j. Report date
- 2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
- 3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
- 4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
- 5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
- 6. Air Cooled Condenser:
 - a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Number of compressors
- 7. Cooling Coil Data:
 - a. Identification/number

- b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Entering air DB temperature, design and actual
 - g. Entering air WB temperature, design and actual
 - h. Leaving air DB temperature, design and actual
 - i. Leaving air WB temperature, design and actual
 - j. Water flow, design and actual
 - k. Water pressure drop, design and actual
 - l. Entering water temperature, design and actual
 - m. Leaving water temperature, design and actual
 - n. Saturated suction temperature, design and actual
 - o. Air pressure drop, design and actual
8. Heating Coil Data:
- a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Air flow, design and actual
 - f. Water flow, design and actual
 - g. Water pressure drop, design and actual
 - h. Entering water temperature, design and actual
 - i. Leaving water temperature, design and actual
 - j. Entering air temperature, design and actual
 - k. Leaving air temperature, design and actual
 - l. Air pressure drop, design and actual
9. Air Moving Equipment:
- a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual per pitot readings at equipment and per totaled outlets.
 - g. Return air flow, specified and actual per pitot readings at equipment and per totaled inlets.
 - h. Outside air flow, specified and actual per pitot.
 - i. External and total static pressure, specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
10. Return Air/Outside Air Data:
- a. Identification/location
 - b. Design return air flow
 - c. Actual return air flow per pitot readings at equipment and per totaled grilles air flow measurement
 - d. Design outside air flow

- e. Actual outside air flow per pitot readings
 - f. Return air temperature
 - g. Outside air temperature
 - h. Required mixed air temperature
 - i. Actual mixed air temperature
 - j. Design outside/return air ratio
 - k. Actual outside/return air ratio
11. Exhaust Fan Data:
- a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual per pitot readings at exhaust fan and per totaled exhaust grilles or duct inlets.
 - f. Static pressure, specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
12. Duct Traverse:
- a. System zone/branch and at all equipment (AHUs, RTUs, EFs, etc.)
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
13. Duct Leak Test:
- a. Description of ductwork under test
 - b. Duct design operating pressure
 - c. Duct design test static pressure
 - d. Duct capacity, air flow
 - e. Maximum allowable leakage duct capacity times leak factor
 - f. Test apparatus
 - 1) Blower
 - 2) Orifice, tube size
 - 3) Orifice size
 - 4) Calibrated
 - g. Test static pressure
 - h. Test orifice differential pressure
 - i. Leakage
14. Air Distribution Test Sheet:
- a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size

- e. Area factor
- f. Design velocity
- g. Design air flow
- h. Test (final) velocity
- i. Test (final) air flow
- j. Percent of design air flow
- 15. Sound Level Report:
 - a. Location
 - b. Octave bands-equipment off
 - c. Octave bands-equipment on
- 16. Vibration Test:
 - a. Location of points:
 - 1) Fan bearing, drive end
 - 2) Fan bearing, opposite end
 - 3) Motor bearing, center (if applicable)
 - 4) Motor bearing, drive end
 - 5) Motor bearing, opposite end
 - 6) Casing (bottom or top)
 - 7) Casing (side)
 - 8) Duct after flexible connection (discharge)
 - 9) Duct after flexible connection (suction)
 - b. Test readings:
 - 1) Horizontal, velocity and displacement
 - 2) Vertical, velocity and displacement
 - 3) Axial, velocity and displacement
 - c. Normally acceptable readings, velocity and acceleration
 - d. Unusual conditions at time of test
 - e. Vibration source (if non-complying)

END OF SECTION

MAI: 2024-2701

SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES EXTERNAL INSULATION FOR:

- A. Supply air ducts.
- B. Return air ducts.
- C. Ducts located outdoors.
- D. Kitchen hood exhaust duct insulation.
- E. Furnace exhaust vent pipes.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or end use:
 - 1. American Society for Testing of Materials and Specifications:
 - a. ASTM C533, "Standard Specification for Calcium Silicate Pipe and Block Insulation"
 - b. ASTM C553, "Standard Specification for Mineral Fiber Blanket and Felt Insulation"
 - c. ASTM C612, "Standard Specification for Mineral Fiber Block and Board Thermal Insulation"
 - d. ASTM C1136, "Standard Specification for Barrier Material, Vapor," Type 1 or 2 (jacket only)
- B. Insulation materials, including all weather and vapor barrier material, closures, hangers, supports, fitting covers, and other accessories shall be furnished and installed in strict accordance with project drawings, plans and specifications.

1.4 SCOPE

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and performing all operations required, for the correct fabrication and

installation of thermal insulation applied to commercial ductwork systems in accordance with the applicable project specifications, and drawings, subject to the terms and conditions of the contract.

- B. The above temperature ranges are typical for these systems. However, if contract specifications call for service temperatures outside the above ranges, consult the manufacturer's published data to determine the operating temperature limitations of the insulation products or products under consideration.

1.5 DEFINITIONS

- A. The term "mineral fiber" as defined by the above specifications includes fibers manufactured of glass, rock, or slag processed from a molten state with or without binder.
- B. Exposed ductwork shall include ductwork installed in areas used by personnel in the normal use of the building, such as finished work rooms, offices, mechanical rooms, storage rooms, etc.
- C. Exposed finished areas include areas that normally have finished walls, ceilings, floors, etc. such as offices.
- D. Concealed ductwork shall include ductwork installed in areas similar to pipe tunnels, covered pipe trenches, spaces inside walls, duct or pipe shafts, spaces above dropped ceilings, unfinished attic spaces, crawl spaces, etc.

1.6 SYSTEM PERFORMANCE

- A. Insulation materials furnished and installed hereunder should meet the minimum economic insulation thickness requirements of the North American Insulation Manufacturer's Association (NAIMA) (Formerly known as TIMA), to ensure cost effective energy conservation performance. Alternatively, materials should exceed the minimum thickness requirements of National Voluntary Consensus Standard 90.1 (1989), energy Efficient Design of New Buildings", of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor.
- B. Insulation materials furnished and installed hereunder shall be Class A, maximum of 25 flame spread, 35 fuel contributed and 50 smoke developed rating and shall meet the fire hazard requirements of the following specifications:
 - 1. American Society for Testing of Materials ASTM E84
 - 2. Underwriter's laboratories, Inc. UL 723
 - 3. National Fire Protection Association NFPA 255
- C. Calcium silicate products shall include a visual identification system to permit positive field determination of their asbestos-free characteristic.

1.7 QUALITY ASSURANCE

- A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

1.8 DELIVERY AND STORAGE OF MATERIALS

- A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- B. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during and after installation. No insulation materials shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- C. If any insulation material has become wet the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

PART 2 PRODUCTS

2.1 DUCTWORK AND STACKS LOCATED INDOORS

- A. Ductwork shall be externally insulated with Fiberglas insulation in blanket, batt or board form, selected to conform readily to the surface to which it will be applied. Vapor barrier shall be legibly printed by the manufacturer to indicate nominal thickness, R-value and type of insulation. External insulation shall be as follows:
 - 1. Concealed Ductwork
 - a. Rectangular, round or oval ductwork: Fiberglas All-Service duct wrap, light density glass fiber insulation in roll form, 1½" thick, 1.0 lb per cubic foot density, faced with a reinforced foil/kraft laminate vapor barrier. All joints shall be stapled with outward clinching staples and where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.
 - 2. Ductwork Located in Attic Space
 - a. Rectangular, round or oval ductwork: Fiberglas All-Service duct wrap, light density glass fiber insulation in roll form, 2" thick, 1.0 lb per cubic foot density, faced with a reinforced foil/kraft laminate vapor barrier. All joints shall be stapled with outward clinching staples and where a vapor

barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.

3. Exposed Rectangular Ductwork
 - a. Rectangular: Fiberglas type 705, 2" thick, 6.0 lbs per cubic foot density insulation, heavy density glass fiber insulation in semi-rigid or rigid board form, faced with reinforced foil/kraft laminate vapor barrier. All joints shall be stapled with outward clinching staples and where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.
4. Exposed Round or Oval Ductwork
 - a. Cross Section less than 10" diameter: Fiberglas all-service duct wrap, 1½" thick, 1.5 lb per cubic foot density, with FSK foil face. All joints shall be stapled with outward clinching staples and where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping. If installed in high abuse areas like gymnasiums or locker rooms, use 1" thick elastomeric with foil type wrap (similar to Venture Clad Plus).
 - b. Cross section 10" or more in diameter: Fiberglas, Pipe and Tank Insulation, heavy density glass 1½" thick 4.5 lb per cubic foot density, semi-rigid insulation, end grain factory-adhered to ASJ all-service jacket. All joints shall be stapled with outward clinching staples where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.
5. Furnace Exhaust Vent Pipe
 - a. Insulate furnace exhaust vent pipe with ¾" thick Armstrong armaflex type AP insulation per furnace manufacturing recommendation.
 - b. Insulation shall be flexible elastomeric thermal insulation, black in color, flame-spread rating of 25 or less and smoke developed rating of 50 or less as tested by ASTM E84-91A "Method of Test Surface Burning Characteristics of Building Materials".
 - c. Fitting covers shall be fabricated from miter-cut tubular form. In all cases, butt joints and seams are to be sealed with Armstrong 520 adhesive. 520 adhesive is a contact adhesive; therefore, in all cases, both surfaces to be joined are to be coated with adhesive.
 - d. Where vent piping is located outdoors, cover with PVC jacketing installed with a glued application.
6. Boiler or Water Heater Stack.
 - a. 2" thick Owens-Corning Calcium Silicate block insulation, rated for maximum operating temperature of 1200°F, rigid hydrous asbestos-free calcium silicate block insulation. Molded flat blocks shall be used for flat sur

faces. V-grooved block shall be used on curved surfaces, and shall be such that the V-grooves close tightly over the curved surface.

- 1) Insulation shall be mechanically fastened in place by bands wired or welded to rods or studs.
- 2) A troweled coat of insulating cement shall be used to provide the base for the finished surface.
- 3) The insulation shall be protected with a .016 aluminum jacket. ASJ jacketing shall not be used over calcium silicate.

7. Kitchen Hood Exhaust Duct wrap

- a. Duct wrap shall be Fire Master as Manufactured by 3M (Fire Barrier Products).
- b. Duct wrap shall be a 1½" thick, refractory ceramic fiber blanket encapsulated with aluminum foil scrim.
- c. Duct wrap shall be classified by Underwriters Laboratories in the 1994 Fire Protection Equipment Directory under Grease Duct Enclosures, #YYET, R14229.
- d. Duct wrap shall be tested to ASTM E84/UL 723 flammability test with a flame spread and smoke developed rating of 5.
- e. Duct penetration protection incorporating Fire Master duct wrap shall have been tested to ASTM E814/UL 1479 and listed in the U.L. Fire Resistance Directory Vol. II under System No. C-AJ-7004.
- f. Duct wrap shall have a thermal resistance R value of 4.15 per inch at 70 degrees F.
- g. Stainless steel banding shall be utilized with two layers of duct wrap to obtain a 2 hour rated enclosure of the duct.
- h. Fire Wrap duct wrap manufactured by Unifrax meeting similar requirements will be an approved equal.
- i. Entire installation to be in accordance with manufacturers recommendations, the building code, State Fire Marshall requirements, NFPA 96 and other applicable codes and standards.

8. Accessory Materials

- a. Accessory materials installed as part of insulation work under this section shall include (but not be limited to):
 - 1) Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure sensitive tapes.
 - 2) Field-applied jacketing materials - Sheet metal, plastic, canvas, fiberglass cloth, insulating cement; PVC fitting covers.
 - 3) Support materials - Hanger straps, hanger rods, saddles.
 - 4) Fasteners, weld pins/studs, speed clips, insulation washers.
 - 5) Metal mesh or expanded metal lagging.
- b. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions and/or in conformance with the current edition of the Midwest insulation

Contractors Association (MICA) "Commercial & Industrial Insulation Standards".

9. Ductwork Located Outdoors
 - a. All ductwork (supply, return, exhaust, outside air, relief air) located outdoors shall be covered externally with either 3" of flexible elastomeric closed-cell insulation or 4" of Foamglas® closed cell insulation (R-12 min.).
 - b. Installation shall meet manufacturer's recommendations, with all joints firmly butted and secured with adhesives or fasteners.
 - c. All ductwork insulation shall be jacketed with a multi-ply, fabric reinforced, self-adhesive insulation cladding material with a vapor barrier and a thickness of 0.015". Jacketing system shall be Venture Clad Plus #1579CW-E, or equal.
 - d. Install all insulation and jacketing in accordance with manufacturer's installation instructions.
 - e. Rectangular ductwork shall be installed with a crown or slope on top to prevent water from ponding. Insulation and jacketing shall be installed on top of duct and crown or slope shim.
 - f. Jacketing shall be installed to each of the sides separately, starting with bottom, then sides and finally the top. Each side shall overlap the other by 3". The sides shall overlap the bottom and the top shall overlap the sides.
 - g. All jacketing seams must be taped with manufacturer's recommended jointing/seaming tape.
 - h. All underlying foil faced insulation must be sealed with foil or FSK tape.
10. Ductwork Located in Unconditioned Attic Space
 - a. All ductwork routed through unconditioned attic spaces shall be insulated, even if not called to be insulated, when located in an unconditioned space. Supply air ductwork insulation thickness in an unconditioned attic space shall be twice (double) the insulation thickness listed in the specification.

PART 3 EXECUTION

3.1 SITE INSPECTION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments that all materials and accessories to be installed on

the project comply with applicable specifications and standards and meet specified thermal and physical properties.

3.2 PREPARATION

- A. Ensure that all seams and joints in ductwork have been sealed by the contractor responsible for duct systems.
- B. Ensure that pressure testing of duct systems has been completed prior to installing insulation.
- C. Ensure that all duct surfaces over which or within which insulation is to be installed are clean and dry.
- D. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.

3.3 INSTALLATION

- A. General
 - 1. Install insulation in accordance with manufacturer's published instructions and recognized industry practice to ensure that it will serve its intended purpose.
 - 2. Install insulation materials with smooth and even surfaces. Butt joints firmly together to ensure complete and tight fit over surfaces to be covered.
 - 3. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. All staples used on ductwork insulation shall be coated with suitable sealant to maintain vapor barrier integrity.
- B. Penetrations
 - 1. Extend ductwork insulation without interruption through walls, floors etc., except at fire dampers or unless noted otherwise.
- C. Duct Wrap Insulation
 - 1. Insulation shall be applied to sheet metal ductwork or plenums with all joints butted firmly together, using manufacturer's recommended stretch-out tables (see Owens-Corning Pub. No. 3-MS-9266) to prevent excessive compression. Insulation shall be secured with mechanical fasteners spaced at 16" maximum centers on the bottom of 24" or wider ducts to prevent the insulation from sagging.
 - 2. All joints shall be firmly butted together and where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.
- D. Rigid Insulation
 - 1. Board shall be secured to ductwork with adhesive or with mechanical fasteners with welded pins, secured with insulation caps and washers

matching color of the vapor barrier facing. If used, mechanical fasteners shall be within 3" (max.) of board edges, 12" maximum on center.

2. All joints shall be firmly butted together and where a vapor barrier is required, sealed with pressure sensitive tape matching the facing, FRK backing stock or glass fabric and mastic. Adjacent sections shall be tightly butted with the 2" tape flap overlapping.
3. Corner angles shall be installed on all external corners of rigid duct insulation in exposed finished areas before jacketing, except kitchen hood exhaust duct insulation which shall have no corner angles.

E. Kitchen Hood Exhaust Duct Insulation

1. Two layers of Fire Master duct wrap shall be installed, applied directly to duct. A 3" perimeter and longitudinal overlap shall be employed on both layers. Filament tape shall be used as a temporary hold until the stainless steel banding is in place.
2. For duct spans of 24" or greater, insulation pins shall be utilized on the bottom of horizontal or vertical duct to prevent sagging.
3. Installation shall be in accordance with manufacturers recommendations.

3.4 FIELD QUALITY ASSURANCE

- A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

3.5 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. Protect the insulation work during the remainder of the construction period to avoid damage and deterioration of the finished insulation work.

3.6 SAFETY PRECAUTIONS

- A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.
- B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.7 ASBESTOS INSULATION

- A. Any existing asbestos insulation on existing ductwork, equipment, etc. where tie-ins are required, shall be removed by the Owner at the Owner's expense. The Contractor and Architect/Engineer shall not be responsible for any cost or work involved with removal or encapsulation of asbestos insulation.

END OF SECTION

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SECTION 23 09 00

TEMPERATURE CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Products Furnished But Not Installed Under This Section
- B. Related Sections
- C. Description
- D. Approved Control System Contractor
- E. Quality Assurance
- F. Codes and Standards
- G. System Performance
- H. Submittals
- I. Warranty
- J. Ownership of Proprietary Material

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Ductwork Accessories:
 - 1. Automatic Dampers

1.3 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 0 and Division 1.
- B. The following sections constitute related work:
 - 1. Basic Mechanical Requirements
 - 2. Air Distribution Materials and Methods
 - 3. Refrigeration Equipment
 - 4. Air Handling Equipment
 - 5. Air Distribution
 - 6. Test and Balance
 - 7. Basic Electrical Requirements
 - 8. Basic Electrical Materials

- 9. General Wiring
- 10. Equipment and Motor Wiring
- 11. Uninterruptible Power Supply
- 12. Emergency Systems

1.4 DESCRIPTION

- A. General: The control system shall be as indicated on the drawings and described in the specifications, and consist of a peer-to-peer network of digital building control panels and operator workstation(s). The user interface shall through any personal computer available on the network. The PC shall provide users an interface with the system though dynamic color graphics of building areas and systems.
- B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.
- C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by operator ID and password. An operator shall be able to log onto any PC on the designated network and have access to all designated data.
- D. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.
- E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. A modem or internet connectivity may be provided for remote access to the system.

1.5 WORK INCLUDED

- A. The BAS Contractor shall provide a complete and operational system that will perform the sequences of operation as described herein.
- B. Furnish a complete distributed direct digital control system in accordance with this specification. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
 - a. Provide a submittal that meets the requirements for approval.
 - b. Coordinate installation schedule with the mechanical contractor and general contractor.
 - c. Provide installation of all panels and devices unless otherwise stated.
 - d. Provide power for panels and control devices unless otherwise stated.
 - e. Provide all low voltage control wiring for the DDC system.
 - f. Provide miscellaneous control wiring for HVAC and related systems regardless of voltage.

- g. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
 - h. Provide testing, demonstration and training as specified below.
 - i. Provide emergency power for all control panels where mechanical equipment is on emergency power or needed for heating the space.
- C. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.
- D. Provide new DDC BACnet controls for all new equipment, including but not limited to new roof top units (RTU-5,6,7,8,9), new exhaust fans (EF-7,8,9,10,11), new make-up air unit (MAU-2).
- E. Provide new DDC BACnet controls for all existing stand-alone equipment, including but not limited to existing roof top units (EX RTU-1,2,3,4), existing exhaust fans (EX EF-1,2,3,4,5,6), existing furnace (EX F-1). The Temperature Control contractor shall provide all required devices to allow existing stand-alone equipment to be integrated into the new control system.
- F. The Temperature Control Contractor shall be responsible for controls, control sequences, control devices, control wiring, etc. of new and existing roof top units, exhaust fans, damper actuators, make-up air unit and furnace.
- G. The Temperature Control Contractor shall coordinate with the Air Balance Contractor to calibrate new equipment.
- H. The Temperature Control Contractor shall provide associated software, color graphics, etc. to control and monitor new and existing equipment.

1.6 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. Approved Control System Contractors and Manufacturers:

	Manufacturer Name	Product Line	Contractor Name/Address	Contact
Base Bid	Trane	Tracer	Trane	
Add or Deduct Alternate	Johnson Controls Corporate	Metasys	Johnson Controls Corporate	
	Honeywell Corporate	Honeywell	Honeywell Corporate	
	Tri City Controls	American Auto-Matrix	Tri City Controls	

1. The above list of manufacturers applies to user interface, controller software, the custom application programming language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturers.

1.7 QUALITY ASSURANCE

A. System Installer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years.
2. The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3. The installer shall have an office within [50] miles of the project site and provide [24-hour] response in the event of a customer call.

1.8 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state and federal authorities. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC)
2. International Building Code (IBC)
3. International Mechanical Code (IMC)
4. Underwriters Laboratories: Products shall be UL-916-PAZX listed.

1.9 SYSTEM PERFORMANCE

A. Performance Standards. The system shall conform to the following:

1. Page Display. The system shall display a web page will be displayed within [5] seconds of the request. There is no maximum amount of dynamic points that can be displayed.- Paul to confirm
2. Page Refresh. The system shall update all within [10] seconds.
3. Graphic Refresh. The system shall update all dynamic points with current data within [30] seconds.
4. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be [10] seconds. Analog objects shall start to adjust within [10] seconds.-
5. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior [60] seconds.

6. Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed [30] seconds.
7. Program Execution Frequency. Custom programs shall be capable of running as often as once every second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
8. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every [5] seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Multiple Alarm Annunciation. All users on the network shall receive alarms within [10] seconds of each other.
10. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	$\pm 0.5^{\circ}\text{C}$ [$\pm 1^{\circ}\text{F}$]
Ducted Air	$\pm 1.0^{\circ}\text{C}$ [$\pm 2^{\circ}\text{F}$]
Outside Air	$\pm 1.0^{\circ}\text{C}$ [$\pm 2^{\circ}\text{F}$]
Water Temperature	$\pm 0.5^{\circ}\text{C}$ [$\pm 1^{\circ}\text{F}$]
Delta-T	$\pm 0.15^{\circ}\text{C}$ [$\pm 0.25^{\circ}\text{F}$]
Relative Humidity	$\pm 5\%$ RH
Water Flow	$\pm 5\%$ of full scale
Air Flow (terminal)	$\pm 10\%$ of reading *Note 1
Air Flow (measuring stations)	$\pm 5\%$ of reading
Air Pressure (ducts)	± 25 Pa [± 0.1 "W.G.]
Air Pressure (space)	± 3 Pa [± 0.01 "W.G.]
Water Pressure	$\pm 2\%$ of full scale *Note 2
Electrical Power	$\pm 5\%$ of reading *Note 3
Carbon Monoxide (CO)	$\pm 5\%$ of reading
Carbon Dioxide (CO ₂)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)

Note 2: for both absolute and differential pressure

Note 3: * not including utility supplied meters

1.10 SUBMITTALS

- A. Contractor shall provide electronic shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.

- B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.
- C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
- D. Submit the following within [60] days of contract award or as required per the construction manager, whichever is more stringent:
 - 1. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
 - 2. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
 - 3. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
 - a. Building Controllers
 - b. Custom Application Controllers
 - c. Application Specific Controllers
 - d. Operator Interface Computer(s)
 - e. Portable Operator Workstation
 - f. Auxiliary Control Devices
 - g. Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling
 - h. Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled
 - i. Points list showing all system objects, and the proposed English language object names
 - j. Sequence of operations for each system under control. This sequence shall be specific for the use of the Control System being provided for this project
 - k. Color prints of proposed graphics with a list of points for display
- E. Project Record Documents. Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
 - 1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.
 - 2. Testing and Commissioning Reports and Checklists.

3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
 - a. Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
 - b. Provide on-line help for documenting operator instructions
 - c. A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
 - d. One set of electronic media containing files of all color-graphic screens created for the project.
 - e. Complete original issue documentation, installation, and maintenance information for all third party hardware provided including computer equipment and sensors.
 - f. Licenses and warranty documents for all equipment and systems.
 - g. Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.
- F. Training Materials: The Contractor shall provide a course outline and training material for all training classes at least six weeks prior to the first class. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.11 WARRANTY

- A. Warrant all work as follows:
 1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
 2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
 3. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.

4. The system provider shall provide a web-accessible system and support on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.

1.12 OWNERSHIP OF PROPRIETARY MATERIAL

- A. All project-developed hardware and software shall become the property of the Owner. These items include but are not limited to:
 1. Project graphic images
 2. Record drawings
 3. Project database
 4. Project-specific application programming code
 5. All documentation

PART 2: PRODUCTS

2.1 SECTION INCLUDES

- A. Materials
- B. Communication
- C. Operator Interface
- D. Application and Control Software
- E. Building Controllers
- F. Custom Application Controllers
- G. Application Specific Controllers
- H. Input/Output Interface
- I. Auxiliary Control Devices
- J. Variable frequency drives

2.2 MATERIALS

- A. All products used in this installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of 2 years. The installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing. Spare parts shall be available for at least 5 years after completion of this contract.

2.3 COMMUNICATION

- A. This project shall comprise of a network utilizing high-speed [BACnet] for communications between Building Controllers. . LonTalk or BACnet MSTP sub-networks shall be used for communications between Building Controllers, Custom Application Controllers and Application Specific Controllers.
- B. The Owner will provide all communication media, connectors, repeaters, network switches, and routers necessary for the internetwork. An active Ethernet jack will be provided adjacent to each Building Control Panel and PC Workstation for connection to this network.

All Building Controllers shall have a Ethernet communications port for connections with the operator interfaces.

- C. Remote operator interface via a 56K baud modem shall allow for communication with any and all controllers on this network as described in the following paragraph.
- D. Communications services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:
 - 1. Connection of an operator interface device to any one building controller on the internetwork will allow the operator to interface with all other building controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all building controllers shall be available for viewing and editing from any one building controller on the internetwork.
 - 2. All database values (i.e., points, software variable, custom program variables) of any one building controller shall be readable by any other building controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to a point name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communications services to perform internetwork value passing.
- E. The time clocks in all building controllers shall be automatically synchronized daily.

2.4 OPERATOR INTERFACE

- A. Operator Interface. Web server shall reside on high-speed network with building controllers. Each standard browser connected to server shall be able to access all system information. The Operator Workstation or server shall conform to the BACnet Operator Workstation (B-OWS) or BACnet Advanced Workstation (B-AWS) device profile as specified in ASHRAE/ANSI 135 BACnet Annex L.
- B. Communication. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone

shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

C. User Interface

1. Operating System. Web server or workstation shall have an industry-standard professional-grade operating system. Operating system shall meet or exceed the DDC System manufacturer's minimum requirements for their software. Acceptable systems include Microsoft Windows 10 or most recent, Windows Server 2016 or most recent, Red Hat Enterprise Linux 7 or most recent, or Ubuntu Desktop 17.04 or most recent.
2. User interface. The system user interface shall be web based graphically orientated. Provide a method for the operator to easily move between web pages. Dynamic points shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation of equipment. Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
3. Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as BMP, GIF and JPEG.
4. Graphics Library. Furnish a library of standard HVAC equipment including, air handling units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.
5. Engineering Units. Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system. Unit selection shall be able to be customized by locality to select the desired units for each measurement. Engineering units on this project shall be Inch /Pound.

D. System Applications. Each building controller shall provide storage of system information. Provide the following applications at each building controller.

1. Database Save and Restore. A system operator with the proper password clearance shall be able to archive the database on the designated operator interface PC. The operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
2. System Configuration. The workstation software shall provide a graphical method of configuring the system. The user with proper security shall be able to add new devices, and assign modems to devices. This shall allow for future system changes or additions.
3. On-Line Help and Training. Provide a context sensitive, on line help system to assist the operator in operation and editing of the system. On-line help shall be available for all system functions and shall provide the

- relevant data for that particular screen. Additional help shall be available through the use of hypertext links onscreen.
4. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. All system security data shall be stored in an encrypted format.
 5. System Diagnostics. The system shall automatically monitor the operation of all, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
 6. Alarm Notification. Operator shall be notified of new alarm as they occur while navigating through any part of the system with a alarm icon. Alarm messages shall use full language, easily recognized descriptors for alarm. System will have the capability to acknowledge Alarms and add and save comments for the alarm.
 7. Alarm Processing. Any object in the system shall be configurable to alarm in and out of normal state. The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.
 8. Alarm Reactions. A user shall be able to determine what actions will occur if any, upon receipt of an alarm. Actions shall display on the screen, logging, start a custom control program, displaying messages, send a SMTP e-mail message that can be directly displayed on a smart phone, or forwarded to a cell phone via a text message. . Each of these actions shall be configurable by any PC and time of day.
 9. Event Log. The operator shall be able to view all logged system alarms and events from any location in the system. The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in up to 4 categories based on severity. An operator with the proper security level may acknowledge and clear alarms. All that have not been cleared by the operator shall be stored by the building controller. Provide a comment field in the event log that allows a user to add specific comments associated with any alarm.
 10. Trend Logs. The system shall automatically create trend logs for a minimum of 5 key measurements for each controlled HVAC device. The automatic trend logs shall monitor these parameters for a minimum of 24 hours at 15 minute intervals. The automatic trend logs shall be user adjustable. A user shall also be able to define a trend log for any data in the system. This definition shall include interval, start-time, and stop-time. Trend intervals shall be as frequently as 1minute up to yearly sampling and shall be selectable. Trend data shall be sampled and stored on the Building Controller panel and can be archived on a PC. Trend data shall be able to be viewed and printed from the operator interface software. Trends must be viewable in a text-based format or graphically. Trends

shall also be storable in a CSV or PDF format for use by other industry standard word processing and spreadsheet packages.

11. Dynamic Graphical Trending. The system shall have the ability to save the data collected by a trend object and display that collected data in a graphical chart. Trend viewing capabilities shall include the ability to show up to 6 points on a chart, to include live and/or historical data. Each data point trend line shall be an individual color. Navigation and viewing functions shall include scrolling and zooming of x and y axes, and a trace display of the associated time stamp, and values for any selected point along the x-axis.
13. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. These statuses shall be available by menu, on graphics or through custom programs.
14. Clock Synchronization. A designated building controller shall synchronize all other building controllers on the network. A building controller shall also be able to synchronize with a NTP server for automatic time synchronization. The system shall automatically adjust for daylight savings time if applicable.
15. Reports and Logs. Provide a reporting package that allows the operator to select reports. A number of different reports shall be available to be selected by the user and provide current data. All reports can be set up to be run at specified intervals of time. Reports and logs shall be stored on the building controller in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Reports and logs shall be readily printed to the system printer. The operator shall be able to designate reports that shall be printed or stored to disk at selectable intervals. Provide a means to list and access the last 10 reports viewed by the user.
 - a. All Points in Alarm Report: Provide an on demand report showing all current alarms.
 - b. All Points in Override Report: Provide an on demand report showing all overrides in effect.
 - c. Commissioning Report: Provide a one time report that lists all equipment with the unit configuration and present operation.
 - d. Points report: Provide a report that lists the current value of all points

E. Workstation Applications Editors. Each PC workstation shall support dedicated screens for editing of all system applications. Provide editors for each application at the PC workstation. The applications shall be downloaded and executed at the appropriate controller panels.

1. Controller. Provide a full screen editor for each type custom application, and application specific controller that shall allow the operator to view and change the configuration, name, control parameters, and system set-points.
2. Scheduling. An editor for the scheduling application shall be provided at each workstation. Provide a monthly calendar for each schedule.

- Exception schedules and holidays shall be shown clearly on the calendar. Provide a method for allowing several related objects to follow a schedule. An advance and delay time for each object shall be adjustable from this master schedule. An operator shall be able to modify the schedule. Schedules shall be able to be easily copied between objects and/or dates.
3. Manual Control and Override. Provide a means of manually controlling analog and binary output points. Control overrides shall be performed through a simple. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.
 4. Air System Equipment Coordination. Provide editor screens with monitoring and control functions that group together and coordinates the operation of air handling equipment and associated VAV boxes as specified in the sequence of operations. For each air system, the editor pages shall include:
 - a. System mode of the air handling system
 - b. Listing and assignment of the associated air handler and VAV boxes
 - c. RTU supply air cooling and heating set points
 - d. RTU minimum, maximum and nominal static pressure set points
 - e. VAV box minimum and maximum flow, and drive open and close overrides

2.5 APPLICATION AND CONTROL SOFTWARE

- A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator workstation.
- B. System Security
 1. User access shall be secured using individual security passwords and user names.
 2. Passwords shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator
 3. User logon/logoff attempts shall be recorded.
 4. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
- C. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
 1. Weekly Schedule. Provide separate schedules for each day of the week.

2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
 3. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
 4. Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less than and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
- D. Remote Communications. The system shall have the ability to transmit alarms to multiple associated alarm receivers. Receivers shall include PC Workstations, email addresses, and cell phones. The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system utilizing the system Ethernet communications, or dial up communications via modem, in the same format and method used on site as described under the Operator Interface section of this specification.
- E. PID Control. A PID (proportional-integral-derivative) algorithm with direct or reverse action and anti-wind-up shall be supplied. The algorithm shall calculate a time-varying analog value used to position an output or stage a series of outputs. The controlled variable, and set-point, shall be user-selectable. The set-point shall optionally be chosen to be a reset schedule.
- F. Point control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events
- G. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, workstation, or the operator display. The amount of time that the override takes precedence will be selectable from the workstation.
- H. Anti-Short Cycling. All binary output points shall be protected from short cycling.

2.6 BUILDING CONTROLLERS

- A. General. Provide Building Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
1. The Building Automation System shall be composed of one or more independent, standalone, microprocessor based Building Controllers to manage the global strategies described in System software section.
 2. The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 3. The controller shall provide a USB communications port for connection to a PC
 4. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 5. Controllers that perform scheduling shall have a real time clock.
 6. Data shall be shared between networked Building Controllers.
 7. The Building Controller shall utilize industry recognized open standard protocols for communication to unit controllers.
 8. The Building Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
 - a. Assume a predetermined failure mode.
 - b. Generate an alarm notification.
 - c. Create a retrievable file of the state of all applicable memory locations at the time of the failure.
 - d. Automatically reset the Building Controller to return to a normal operating mode.
- B. Communications. Each Building Controller shall reside on a BACnet internetwork using the IEEE 802.3 (Ethernet) Physical/Data Link layer protocol. Each Building Controller shall also perform routing to a network of Custom Application and Application Specific Controllers.] [Optional – Each Building Controller shall perform communications to a network of Custom Application and Application Specific Controllers using LonTalk FTT-10 and LonMark profiles and/or use BACnet MSTP as prescribed by the BACnet standard to perform communications to a network of Custom Application and Application Specific Controllers.]
- C. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at -40 C to 50 C [-40 F to 122 F].
- D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. The Building Controller shall have a display on the main board that indicates the current operating mode of the controller. All wiring connections shall be made to field removable, modular terminal connectors. The building controller shall utilize standard DIN mounting methods for installation and replacement.

- E. Memory. The Building Controller shall maintain all BIOS and programming information indefinitely without power to the building controller
- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage

2.7 CUSTOM APPLICATION CONTROLLERS

- A. General. Provide Custom Application Controllers to provide the performance specified in section 1 of this division. Each of these panels shall meet the following requirements.
 - 1. The Controller shall have sufficient memory to support its operating system, database, and programming requirements.
 - 2. Controllers that perform scheduling shall have a real time clock.
 - 3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
 - 4. The Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall assume a predetermined failure mode, and generate an alarm notification.
 - a. Custom application controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall be with the use of LonMark-approved SNVTs.
- B. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.
 - 1. Controller used in conditioned ambient shall be mounted in IP 20 type enclosures, and shall be rated for operation at 0 C to 50 C [32 F to 120 F].
 - 2. Controllers used outdoors and/or in wet ambient shall be mounted within IP 56 type waterproof enclosures, and shall be rated for operation at -40 C to 70 C [-40 F to 158 F].
- C. A local operator interface shall be provided at building locations where specified in the sequence of operations or point list. The operator interface shall be provided for interrogating and editing data. A system security password shall be available to prevent unauthorized use of the keypad and display.
- D. Serviceability. Provide diagnostic LEDs for power, communications, and processor. All low voltage wiring connections shall be made such that the controller electronics can be removed and/or replaced without disconnection of field termination wiring.
- E. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.

- F. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

2.8 APPLICATION SPECIFIC CONTROLLERS

- A. General. Application specific controllers (ASC) are microprocessor-based DDC controllers, which through hardware or firmware design are dedicated to control a specific piece of equipment. They are not fully user programmable, but are customized for operation within the confines of the equipment they are designed to serve.
 - 1. Each ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
 - 2. Each ASC will contain sufficient I/O capacity to control the target system.
- B. Environment. The hardware shall be suitable for the anticipated ambient conditions.
 - 1. Controller used in conditioned ambient spaces shall be mounted in IP 20 type rated enclosures. Controllers located where not to be disturbed by building activity (such as above ceiling grid), may be provided with plenum-rated enclosures and non-enclosed wiring connections for plenum cabling. All controllers shall be rated for operation at 0 C to 50 C [32 F to 120 F].
 - 2. Controllers used outdoors and/or in wet ambient shall be mounted within IP 56 type waterproof enclosures, and shall be rated for operation at -40 C to 65 C [-40 F to 150 F].
- C. Serviceability. Provide diagnostic LEDs for power and communications. All wiring connections shall be clearly labeled and made to be field removable.
- D. Memory. The Application Specific Controller shall maintain all BIOS and programming information in the event of a power loss for at least 90 days.
- E. Immunity to Power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.
- F. Transformer. Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.
- G. Application Specific Controllers shall communicate using LonTalk. Controllers shall use FTT-10 transceivers. All communications shall follow LonMark profiles. ASCs which do not have a profile that applies must comply with LonMark standards, utilize SNVTs for all listed points, and be provided with a XIF file for self-documentation.

2.9 INPUT/OUTPUT INTERFACE

- A. Hard-wired inputs and outputs may tie into the system through Building, Custom, or Application Specific Controllers.
- B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.
- C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.
- D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and also accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.
- E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.
- F. Binary outputs on custom application controllers shall have 3-mode (on/off/auto) program override control from the panel with output status lights.]
- G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the output device. [Optional: Analog outputs on custom application controllers shall have a 2-mode (auto/manual) program override control, with manual output adjustment over 0-100% of range.]

2.10 AUXILIARY CONTROL DEVICES

- A. Motorized dampers, unless otherwise specified elsewhere, shall be as follows:
 - 1. Damper frames shall be 16 gauge galvanized sheet metal or 1/8" extruded aluminum with reinforced corner bracing.
 - 2. Damper blades shall not exceed 8" in width or 48" in length. Blades are to be suitable for medium velocity performance (2,000 fpm). Blades shall be not less than 16 gauge.
 - 3. Damper shaft bearings shall be as recommended by manufacturer for application.
 - 4. All blade edges and top and bottom of the frame shall be provided with compressible seals. Side seals shall be compressible stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at 2.5" w.c. differential pressure.
 - 5. All leakage testing and pressure ratings will be based on AMCA Publication 500.

6. Individual damper sections shall not be larger than 48" x 60". Provide a minimum of one damper actuator per section.
- B. Control dampers shall be parallel or opposed blade types as scheduled on drawings.
- C. Electric damper/valve actuators.
1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
 2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
 3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.
 4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.
 5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.
 6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
 7. Actuators shall be Underwriters Laboratories Standard 873 listed.
 8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.
- E. Binary Temperature Devices
1. Low-Voltage Space Thermostats shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed set point adjustment, 13°C-30°C (55°F-85°F) set point range, 1°C (2°F) maximum differential, and vented cover.
 2. Line-Voltage Space Thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed set point adjustment, 13°C-30°C (55°F-85°F) set point range, 1°C (2°F) maximum differential, and vented cover.
 3. Low-Limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.
- F. Temperature Sensors

1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 1.5m [5 feet] in length.
3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
4. Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings.
5. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.1 C [0.2 F].
6. The space temperature, set point, and override confirmation will be annunciated by a digital display for each zone sensor. The set point will be selectable utilizing buttons.
7. Individual set point adjustment at the space temperature sensor shall be limited to +/- 3 degrees from BAS set point.

G. Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20% to 80% with accuracy of $\pm 5\%$ R.H.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. It shall be suitable for ambient conditions of -40 C to 75 C [-40 F to 170 F].
4. Humidity sensor's drift shall not exceed 1% of full scale per year.

H. Static Pressure Sensors

1. Sensor shall have linear output signal. Zero and span shall be field-adjustable.
2. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.
3. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.
4. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

I. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one foot section.

2. Low limit shall be manual reset only.

J. Flow Switches

1. Flow-proving switches shall be differential pressure type, as shown.
2. enclosure unless otherwise specified:
3. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), IP 20 Type enclosure, with scale range and differential suitable for intended application, or as specified.
4. Current sensing relays may be used for flow sensing or terminal devices.

K. Relays

1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide IP 20 Type enclosure when not installed in local control panel.

L. Transformers and Power Supplies

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 70.0 mV maximum Peak-to-Peak. Regulation shall be 5% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
3. Unit shall operate between 0 C and 50 C.
4. Unit shall be UL recognized.

M. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

N. Local Control Panels

1. All indoor control cabinets shall be fully enclosed IP 20 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.
2. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock

- drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide on/off power switch with over-current protection for control power sources to each local panel.

2.11 VARIABLE FREQUENCY DRIVES

- A. Subject to compliance with these specifications, the following VFD manufacturers shall be acceptable:

1. AC Tech
2. ABB
3. Yaskawa
4. Danfoss

- B. Variable Frequency Drive (VFD)

1. The variable frequency drive(s) shall be pulse width modulation (PWM) type, microprocessor controlled design. VFD shall be capable of operating in voltage ranges of 200 to 240V and 380 to 480V AC, +/- 10%, three phase; at frequencies of 48 to 63 Hz.
2. The VFD, including all factory-installed options, shall have UL and cUL approval.
3. Enclosure shall be NEMA 1 ventilated for installation as a wall mounted or freestanding unit, depending on the amp rating. Drive shall be equipped with an input disconnect switch, padlockable in the open position for safety during maintenance, and fuses to protect against ground faults. A hand-off-auto switch and speed potentiometer shall be functional via VFD keypad.
4. VFD shall utilize a full wave rectifier to convert three phase AC to a fixed DC voltage. Power factor shall remain above 0.98 regardless of speed or load. VFDs employing power factor correction capacitors shall not be acceptable.
5. Insulated gate bipolar transistors shall be used in the inverter section to convert the fixed DC voltage to a three phase, adjustable frequency, AC output.
6. The output switching frequency shall be selectable at 4 or 8 kHz. VFDs with an operable carrier frequency above 10 kHz shall not be acceptable.
7. An internal line reactor shall be provided to lower harmonic distortion of the power line and to increase the fundamental power factor.
8. The VFD shall be suitable for elevations to 3300 feet above sea level

without derating. Maximum operating ambient temperature shall not be less than 104 degrees F. VFD shall be suitable for operation in environments up to 95% non-condensing humidity.

9. The VFD shall be capable of displaying the following information in plain English via a 40 character alphanumeric display:
 - a. Output Frequency
 - b. Output Voltage
 - c. Motor Current
 - d. Kilowatts per hour
 - e. Fault identification with text
 - f. Percent torque
 - g. Percent power
 - h. RPM
10. All VFDs shall be warranted for a period of 30 months from date of shipment or 24 months from date of start-up, whichever comes first. This warranty shall cover parts, labor, travel time, and expenses.
11. The Temperature Controls Contractor shall furnish and install all programming devices, sensors, transmitters, and other control components, as required to perform the pump operations described in the sequence of operations.

PART 3 EXECUTION

3.1 SECTION INCLUDES:

- A. Examination
- B. Protection
- C. General Workmanship
- D. Field Quality Control
- E. Wiring
- F. Fiber Optic Cable
- G. Installation of Sensors
- H. Flow Switch Installation
- I. Actuators
- J. Warning Labels
- K. Identification of Hardware and Wiring

- L. Controllers
- M. Programming
- N. Cleaning
- O. Training
- P. Acceptance

3.2 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment is installable as shown, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.3 PROTECTION

- A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.
- B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.4 GENERAL WORKMANSHIP

- A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.
- B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- C. Install all equipment in readily accessible location as defined by chapter 1 article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.
- D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.5 FIELD QUALITY CONTROL

- A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.
- B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.
- C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.6 WIRING

- A. All control and interlock wiring shall comply with the national and local electrical codes and Division 26 of these specifications. Where the requirements of this section differ with those in Division 26, the requirements of this section shall take precedence.
- B. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:
- C. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
- D. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.
- E. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).
- F. Where class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 3 m [10 ft] intervals. Such bundled cable shall be fastened to the structure, using specified fasteners, at 1.5 m [5 ft] intervals or more often to achieve a neat and workmanlike result.
- G. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

- H. Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Control System Contractor shall provide step down transformers.
- I. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.
- J. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with other sections of this specification and local codes.
- K. Size of conduit and size and type of wire shall be the design responsibility of the Control System Contractor, in keeping with the manufacturer's recommendation and NEC.
- L. Control and status relays are to be located in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.
- M. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.
- N. Adhere to Division 26 requirements for installation of raceway.
- O. This Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- P. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.

3.7 FIBER OPTIC CABLE SYSTEM

- A. All cabling shall be installed in a neat and workmanlike manner. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.
- B. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post installation residual cable tension shall be within cable manufacturer's specifications.
- C. Fiber optic cabinets, hardware, and cable entering the cabinet shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii as specified by cable manufacturer shall be maintained.

3.8 INSTALLATION OF SENSORS

- A. Install sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequate for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Install duct static pressure tap with tube end facing directly down-stream of air flow.
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
- G. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.
- H. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.9 FLOW SWITCH INSTALLATION

- A. Install and adjust flow switch in accordance with manufacturers' instructions.
- B. Assure correct flow direction and alignment.

3.10 ACTUATORS

- A. Mount and link control damper actuators per manufacturer's instructions.
 - 1. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.
 - 2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

3.11 WARNING LABELS

- A. Affix labels on each starter and equipment automatically controlled through the DDC System. Warning label shall indicate the following:

CAUTION

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

- B. Affix labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects. Labels shall indicate the following:

CAUTION

This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

3.12 IDENTIFICATION OF HARDWARE AND WIRING

- A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information.
- B. Permanently label or code each point of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 1-cm (1/2") letters on nameplates.
- D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.13 CONTROLLERS

- A. Provide a separate Controller for each major piece of HVAC equipment. A custom application controller may control more than one system provided that all points associated with that system are assigned to the same controller. Points used for control loop reset such as outside air or space temperature are exempt from this requirement.
- B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used.

1. Future use of spare capacity shall require providing the field device, field wiring, points database definition, and custom software. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.14 PROGRAMMING

- A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.
- B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.
- C. Software Programming
 1. Provide programming for the system as written in the specifications and adhere to the sequence strategies provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the Control System Contractor. Imbed into any custom-written control programs sufficient comment statements or inherent flow diagrams to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.
- D. Operators' Interface
 1. Standard Graphics. Provide graphics for each major piece of equipment and floor plan in the building. This includes each Air Handler, VAV Terminal, Fan Coil and Boiler. These standard graphics shall show all points dynamically as specified in the points list.
 2. The controls contractor shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.
 3. As part of this execution phase, the controls contractor will perform a complete test of the operator interface. Test duration shall be a minimum of [16] hours on-site. Tests shall be made in the presence of the Owner or Owner's representative.
- E. Demonstration: A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The contractor shall dedicate a minimum of 16 hours on-site with the Owner and his representatives for a complete functional demonstration of all the system requirements. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation.

3.15 CLEANING

- A. This contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.
- B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.
- C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.16 TRAINING

- A. Provide a minimum of [4] classroom training sessions, [4] hours each, throughout the contract period for personnel designated by the Owner. Computer-based audio-visual training may be substituted for up to [8] hours of hands on training.
- B. Train the designated staff of Owner's representative and Owner to enable them to proficiently operate the system; create, modify and delete programming; add, remove and modify physical points for the system, and perform routine diagnostic and troubleshooting procedures.
- C. Additional training shall be available in courses designed to meet objectives as divided into three logical groupings; participants may attend one or more of these, depending on the level of knowledge required:
 - 1. Day-to-day Operators
 - 2. Advanced Operators
 - 3. System Managers/Administrators
- D. Provide course outline and materials as per Part 1 of this Section. The instructor(s) shall provide one copy of training material per student.
- E. The instructor(s) shall be factory-trained instructors experienced in presenting this material.
- F. Classroom training shall be done using a network of working controllers representative of the installed hardware or at the customer's site.
- G. This training shall be made available in addition to the interactive audio-visual tutorial, provided with the system.

3.17 ACCEPTANCE

- A. The control systems will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

3.17 INSTRUCTIONS TO OTHER CONTRACTORS

A. Control Damper Installation

1. Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.
2. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4" larger than damper dimensions and shall be square, straight, and level.
3. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be equal $\pm 1/8"$.
4. Follow manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
5. Install extended shaft or jackshaft per manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)
6. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to assure proper operation. On multiple section assemblies, all sections must open and close simultaneously.
7. Provide a visible and accessible indication of damper position on the drive shaft end.
8. Support duct-work in area of damper when required to prevent sagging due to damper weight.
9. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

B. Duct Smoke Detection

1. Provide complete submittal data to controls system contractor for coordination of duct smoke detector interface to HVAC systems.
2. This contractor shall provide a dry-contact alarm output in the same room as the HVAC equipment to be controlled.

3.18 COMMISSIONING REPORTS

- A. The following commissioning reports are to be filled out by the temperature control contractor for each piece of HVAC equipment:

Rooftop Unit Standard Report	
	Current Value
Rooftop Unit Tagging	
Model Number	
Serial Number	
Communicating State	
Unit Size - tons	
heat/Cool Mode	
Space Temperature - deg F	
Cooling Setpoint - deg F	
Heating Setpoint - deg F	
Supply Air Temperature - deg F	
Compressor Status	
Compressor A	
Compressor B	
Compressor C	
Compressor D	
Units with Economizers:	
OK to Economize?	
Econ Damper Position - %	
Econ Minimum Position - %	
Outdoor Air Temp - deg F	
Exhaust Fan Status	
Exhaust Damper Position - %	
Optional Sensors:	
OA Humidity - % RH	
RA Temperature - deg F	
RA Humidity - % RH	
Optional Enthalpy Sensors:	
OA Enthalpy - BTU/LBM	
RA Enthalpy - BTU/LBM	
Heat Output 1 Status	
Heat Output 2 Status	
Heat Output 3 Status	
Supply Fan Status	
Supply Fan: IGV/VFD Position - %	
Space Pressure - IWC	
Space Pressure Setpoint - IWC	
Units with TRAQ Damper Option	
Outdoor Air Flow - CFM	
Outdoor Air Flow Stpt - CFM	

[illegible]

PART 4 - SEQUENCE OF OPERATION

4.1 EXHAUST FAN CONTROL (EF-7)

- A. General: The space served by the power sidewall exhaust fan is controlled in Occupied and Unoccupied modes. The DDC system uses a current switch to monitor the exhaust fan.
- B. Occupied: The DDC system opens the 12"x48" damper section of louver L-1 and turns on the exhaust fan EF-7.
- C. Unoccupied: The 12"x48" damper section of louver L-1 is closed, exhaust fan EF-7 is off.
- D. Operator Workstation: Display the following data:

1. System graphic.
2. Room/Area served.
3. Room/area status, occupied or unoccupied.
4. Fan on-off status.

4.2 EXHAUST FAN CONTROL (EF-8)

- A. General: The space served by the power sidewall exhaust fan is controlled in emergency operation (CO/NO₂ detectors) and additional ventilation (thermostat). The DDC system uses a current switch to monitor the exhaust fan.
- B. Emergency operation: When any of the CO/NO₂ detectors are in alarm, the DDC system opens the 48"x48" damper section of louver L-1 and turns on the exhaust fan EF-8. Once the system is no longer in alarm the system shall continue to operate for 30 minutes (adj) and then return to normal operation. CO/NO₂ detectors shall be programmed to produce alarm status when CO levels exceed 25ppm (adj) or NO₂ levels exceed 3ppm (adj).
- C. Additional ventilation operation: When the space temperature rises above the set point of 80° F (adj.), the DDC system opens the 48"x48" damper section of louver L-1 and turns on the exhaust fan EF-8.
- D. When CO/NO₂ sensors are not in alarm, and space temperature is below set point 80° F (adj.), the 48"x48" damper section of louver L-1 is closed, and the exhaust fan EF-8 is off.
- E. Operator Workstation: Display the following data:
 1. System graphic.
 2. Room/Area served.
 3. Space temperature.
 4. CO/NO₂ alarm status.
 5. Fan on-off status.

4.2 EXHAUST FAN CONTROL (EX EF-1 THROUGH 6 AND NEW EF-9)

- A. General: The space served by the power roof exhaust fan is controlled in Occupied and Unoccupied modes. The DDC system uses a current switch to monitor the exhaust fan.
- B. Occupied: The DDC system turns on the exhaust fan.
- C. Unoccupied: The exhaust fan is off.
- F. Operator Workstation: Display the following data:

1. System graphic.
2. Room/Area served.
3. Room/area status, occupied or unoccupied.
4. Fan on-off status.

4.3 KITCHEN HOOD EQUIPMENT CONTROL (EF-10,11 AND MAU-2)

- A. General: The temperature control contractor shall integrate hood controller into the new BMS system. The hood controller shall be programmed to operate in the following selectable control modes.
1. Automatic: The system operates based on the differential between room temperature and the temperature at the hood cavity or exhaust duct collar. Fans activate at a configurable temperature differential threshold.
 2. Manual: The system operates based on human input to the hood controller.
 3. Schedule: A weekly schedule can be set to run fans for a specified period throughout the day. There are three occupied times per day to allow for the user to set up a time that is suitable to their needs. Any time that is within the defined occupied time, the system will run. During unoccupied time, the system will have an extra offset to prevent unintended activation of the system during a time where the system is not being occupied.
 4. BMS control: The system operates based on the input from the BMS.
 5. Fire: upon activation of the hood fire suppression system, the exhaust fan will come on or continue to run, the hood makeup air will shutdown, and a signal will be sent for activating the shunt trip breaker provided by the electrician. Fuel gas will shut off via a mechanical/electrical gas valve actuated by the hood fire suppression system.
- B. Hood on: Hood controller turns on exhaust fans EF-10, EF-11 and make-up air unit MAU-2 on. MAU-2 heating/cooling stages shall be activated as follows.

Cooling stage:

The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, the stage shall have a user definable (adj.) Minimum runtime.

The cooling shall be enabled whenever:

- Outside air temperature is greater than 60°F (adj.).

- And the zone temperature is above cooling setpoint.
- And the fan status is on.

Gas heating stages:

The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) Delay between stages, and each stage shall have a user definable (adj.) Minimum runtime.

The heating shall be enabled whenever:

- outside air temperature is less than 65°F (adj.).
- And the zone temperature is below heating setpoint.
- And the fan status is on.

- C. Hood off: Hood controlled turns off exhaust fans EF-10, EF-11 and make-up air unit MAU-2 off.
- D. Operator Workstation: Display the following data:
1. System graphic.
 2. Room/Area served.
 3. Kitchen hood status, system operating modes.
 4. Exhaust fan and MAU on-off status.

4.4 PACKAGED RTU CONTROL (EX RTU-1 THROUGH 4 AND NEW RTU-5 THROUGH 9)

- A. General: The Building Automation System (BAS) shall send the RTU controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. The BAS shall also send the discharge air temperature setpoint and the duct static pressure setpoint. If communication is lost with the BAS the controller shall operate using default modes and setpoints.
- B. Occupied: During occupied periods, the supply fan shall run continuously and the mixed air dampers shall open to maintain minimum ventilation requirements. The unit controller shall control the supply fan speed to maintain the current duct static pressure setpoint (adj.). The DX cooling and the gas heat shall control to maintain the active discharge air temperature setpoint. If economizing is enabled, the

outdoor air or mixed air dampers shall modulate to maintain the discharge air temperature setpoint and the relief air damper shall track the mixed air dampers. If the discharge air temperature sensor fails, the DX cooling shall be disabled, the gas heat shall be disabled, and an alarm shall annunciate at the BAS.

- C. Unoccupied: When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall be commanded on, the outside air damper shall remain closed and the gas heat shall be enabled. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the gas heat shall be disabled. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall be commanded on, the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the Unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the DX cooling shall be disabled and the outside air damper shall close.
- D. Optimal start: The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.
- E. Morning warm-up mode: During optimal start, if the average space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and fan(s). The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.
- F. Pre-cool mode: During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.
- G. Optimal Stop: The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.
- H. Occupied bypass: The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensors. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).
- I: Heat/cool mode:
COOLING: The unit controller shall use the discharge air temperature sensor and discharge air temperature cooling setpoint to determine when to initiate requests

for cooling. Discharge air setpoint shall be maintained by controlling the cooling as required.

HEATING: The unit controller shall use the discharge air temperature sensor and discharge air temperature heating setpoint to determine when to initiate requests for heating. Discharge air setpoint shall be maintained by controlling the heating as required. During Unoccupied Heating or Morning Warm-Up Mode, the unit heat request shall be communicated to the system VAVs prior to commencing heating operation to allow VAV units to open. The variable speed drive shall be commanded to 100% and the heat shall be staged on and off to satisfy the zone temperature setpoint.

- J. Discharge air temperature reset control: The discharge air temperature setpoint, 55.0 deg. F - 65.0 deg. F (adj.) shall be reset based on either the outside air temperature or space average temperature (adj.). The minimum discharge air setpoint shall be set at 55.0 deg. F (adj.). The discharge temperature sensor shall prevent the discharge air temperature from falling below the minimum discharge air setpoint (adj.). If the discharge air temperature continues to fall, the discharge temperature sensor shall act as a low discharge temperature limit, a low temperature alarm shall annunciate, and the unit shall shut down. If the discharge temperature rises above the high limit setpoint the sensor shall act as a high discharge temperature limit and shall keep the unit running, a high temperature alarm shall annunciate.

OUTDOOR AIR TEMPERATURE RESET: The discharge air temperature setpoint shall be adjusted based on the outside air temperature and the cooling and heating load of the building.

SPACE TEMPERATURE RESET: The discharge air temperature setpoint shall be adjusted based on the temperature of the critical space(s).

- K. Economizer: ENABLE (Comparative Dry Bulb): Outside air (OA) temperature shall be compared with space temperature. The economizer shall enable when OA temperature is less than space temperature - 2.0 deg. F. The economizer shall disable when OA temperature is greater than space temperature.

OPERATION: The supply air sensor shall measures the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the discharge air temperature setpoint. The economizer damper shall modulate toward minimum position in the event the discharge air temperature falls below the discharge low limit temperature setpoint. Compressors shall be delayed from operating until the economizer has opened to 100%.

- L: Supply fan: The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode.
- M: Supply duct static pressure control: During the occupied mode the unit controller shall modulate the output to the variable speed drive as required to maintain the duct static pressure setpoint of 1.5 inches of W.C. (adj.). If the duct static

pressure falls below 1.3 inches of W.C. (adj.) the unit controller shall increase the output to the variable speed drive to maintain setpoint. If the duct static pressure rises above 1.7 inches of W.C. (adj.) the unit controller shall decrease the output to the variable speed drive to maintain setpoint. Upon a call for heating or cooling in the unoccupied mode the unit controller shall modulate the speed of the variable speed drive to 100%.

- N: Static pressure high limit: If for any reason the supply air pressure exceeds the supply air pressure high limit, the supply fan shall shut down. The unit shall be allowed to restart three times after a 15 minute off period. If the overpressurization condition occurs on the fourth restart, the unit shall shut down and a manual reset diagnostic is displayed at the remote panel and/or the BAS system.
- O: Relief air and building pressure control: A differential pressure transducer shall actively monitor the difference in pressure between the building (indoors) and outdoors. If the building pressure increases above the differential pressure setpoint, the unit controller shall open the relief air damper, turn on the relief air fan and modulate the relief air fan variable speed drive to control building pressure to the differential pressure setpoint. If the building pressure decreases below the differential pressure setpoint, the associated controller shall deactivate the relief air fan variable speed drive.
- P: Filter status: A differential pressure switch shall monitor the differential pressure across the filter(s) when the fan is running. If the switch closes during normal operation a dirty filter alarm shall annunciate at the BAS.

END OF SECTION

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SECTION 23 30 00

AIR DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casing and plenums.
- D. Single wall spiral duct and fittings
- E. Insulated double wall spiral duct and fittings
- F. Buried ductwork.
- G. Kitchen hood exhaust ductwork.
- H. Dampers.
- I. Duct cleaning.
- J. V.A.V. box with electric heat.
- K. Roof hoods, exhaust fans, grilles and louvers.
- L. Return air fan.
- M. Boiler stack and breeching.
- N. Water heater stack and breeching.
- O. Chemical resistant ductwork.
- P. Operating Room ceiling supply and return air systems.

1.2 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. ASTM A36 - Structural Steel.
- B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

- E. ASTM A480 - General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
- F. ASTM A525 - General Requirements for Steel Sheet.
- G. ASTM A527 - Steel Sheet, Zinc Coated (Galvanized) by Hot Dip Process, Lock Forming Quality.
- H. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low Alloy, Hot-Rolled and Cold-Rolled.
- I. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- J. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- K. AWS D9.1 - Welding of Sheet Metal.
- L. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.
- M. NFPA 54 - National Fuel Gas Code.
- N. NFPA 70 - National Electric Code.
- O. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- P. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- Q. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
- R. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- S. SMACNA - HVAC Air Duct Leakage Test Manual.
- T. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- U. SMACNA - Fibrous Glass Duct Construction Standards.
- V. UL 33 - Heat Responsive Links for Fire Protection Systems.
- W. UL 181 - Factory-Made Air Ducts and Connectors.
- X. UL 555 - Fire Dampers and Ceiling Dampers.

1.3 SCOPE

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and performing all operations required, for the correct and complete

fabrication and installation of ductwork in accordance with the applicable project specifications, drawings, codes, regulations and standards.

1.4 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes will be permitted except by written permission from the Engineer. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed.
- B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing the work of this section with minimum five years experience.

1.7 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and SMACNA standards, latest edition.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

1.9 SPECIAL INSPECTION FOR SMOKE CONTROL (per Michigan Building Code 1704.14)

- A. Special Inspection for Smoke Control: Smoke control systems shall be tested by a special inspector.
- B. Testing scope: The test scope shall be as follows:
 - 1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
 - 2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements, and detection and control verification.

- C. Qualifications: Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

PART 2 PRODUCTS

2.1 DUCT - SHEET METAL HVAC DUCTWORK

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.
- B. Fasteners: Rivets, bolts, or sheet metal screws.
- C. Sealant:
 - 1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic. All ductwork joints, connections, etc. shall be sealed.
- D. Duct Hangers: Rod and trapeze duct support shall be used for all ductwork with one dimension 18" or larger. Smaller duct may be installed with strap hanger system using SMACNA Standard as minimum.
 - 1. Hanger Rod: ASTM A36; steel; threaded both ends, threaded one end, or continuously threaded, with steel angle trapeze and non-eccentric beam clamps.
 - 2. Hanger rods, angles trapeze sizing and spacing shall meet SMACNA standards, and local and state building codes for duct sizes being supported.
 - 3. Straps and hanger attachment system sizing, spacing, and installation shall meet SMANCA Standards, local and state building codes, etc. for duct size and supports.
 - 4. Duct hangers shall not be supported from metal deck. Furnish and install all support steel as required to suspend with beam clamps similar to Grinnell Fig. 260 from structural steel joists or beams.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed. Provide duct material, gages, reinforcing, and sealing for operating pressures not less than 6" w.c. on upstream side (higher pressure side) of variable air volume boxes. Return air duct, exhaust air duct and downstream side of variable air volume boxes (low pressure side) shall be constructed to not less than 2" w.c.
- B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible, and engineer's written approval is obtained, rectangular elbows may be used, provided turning vanes are utilized. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- F. Duct Sealant
- G. All ductwork including supply air, outside air, return air, exhaust air and relief air ductwork shall have joints sealed.
 - 1. Ductwork designed at SMACNA 6" pressure shall meet SMACNA Class "A" seal requirements.
 - 2. Ductwork designed at SMACNA 2" pressure shall meet SMACNA Class "C" seal requirements.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed. Provide duct material, gages, reinforcing, and sealing for operating pressures not less than 6" w.c. unless otherwise noted on drawings.
 - 1. Flat Oval Ducts:
 - a. Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gages heavier metal than duct.
 - 2. Double Wall Insulated Flat Oval Ducts:
 - a. Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1 inch (25 mm) thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.
 - 3. PVC Coated Steel Ducts:
 - a. UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 4 mil (0.1 mm) thick on outside and 2 mil (0.05 mm) thick on inside.
 - 4. Double Wall Insulated Round Ducts:
 - a. Round spiral lockseam duct with galvanized steel outer wall, 1 inch (25 mm) thick fiberglass insulation, perforated galvanized steel inner wall; fitting with solid inner wall.
 - 5. Transverse Duct Connection System:
 - a. SMACNA rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips for not less than 6" w.c. operating pressure unless otherwise noted on drawings.

2.4 SINGLE WALL SPIRAL DUCT AND FITTINGS

A. General

1. All round and/or flat oval spiral duct and fittings shall be manufactured by a company whose primary business is the manufacture of spiral duct and fittings and who has been in business for at least ten (10) years. All spiral duct and fittings shall be manufactured by the same firm and shall be as shown on the contract drawings.
2. All spiral duct and fittings shall be manufactured from G-60 galvanized steel meeting ASTM A924 and A653 requirements, with a prime coat finish.

B. Construction

1. Branch connections shall be made with 90° conical and 45° straight taps as shown on the drawings. All branch connections shall be made as a separate fitting. Factory or field installation of taps to spiral duct shall not be allowed without written approval of the engineer. Manufacturer's published individual fitting performances shall be on file with the design engineer ten (10) days prior to bid.
2. All elbows shall be fabricated with a centerline radius of 1.5 times the diameter. 90° and 45° elbows in diameters 3" round through 10" round shall be stamped or pleated elbows. All other elbows shall be of the gored type, fabricated in accordance with the following:

<u>DEGREE OF ELBOW</u>	<u>NUMBER OF GORES</u>
less than 36°	2
37° thru 71°	3
72° thru 90°	5

Where it is necessary to use two-piece mitered elbows, they shall have a minimum number of vanes in accordance with the following:

<u>DUCT DIAMETER</u>	<u>NUMBER OF VANES</u>
3" thru 9"	2
10" thru 20"	3
21" and up	5

3. Circumferential and longitudinal seams of all fittings shall be a continuous weld or spot welded and sealed with mastic. All welds shall be painted to prevent corrosion.
4. All field joints up to and including 60" shall be made with a 2" slip-fit or slip coupling. Diameters 62" round and larger shall be joined with 2"x2"x3/16" Vanstone flanges for fittings and solid welded flanges for spiral duct.
5. Proprietary connectors such as manufactured by Ductmate or AccuFlange may also be used in lieu of slip connections or angle flanges.
6. Access doors shall be supplied by the duct manufacturer at all fire and/or smoke dampers.
7. All flanges and access doors shall be factory installed. Shipments of loose flanges, access doors or taps for field installation into spiral duct will not be allowed.

C. Metal Gauges

1. Metal gauges for single wall round ducts shall be as follows:

a. Round ducts with maximum 2" W.G. positive static pressure:

<u>DUCT DIAMETER</u>	<u>SPIRAL DUCT</u>	<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>
3" thru 26"	26	24
28" thru 36"	24	22
38" thru 50"	22	20
52" thru 60"	20	18
62" thru 78"	18	16

b. Round ducts with maximum 2" W.G. negative static pressure:

<u>DUCT DIAMETER</u>	<u>SPIRAL DUCT</u>	<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>
3" thru 17"	26	24
18" thru 20"	24	22
21" thru 22"	24	20
24" thru 26"	22	20
28" thru 30"	22	18
32" thru 34"	20	18
36" thru 42"	20	16
44" thru 48"	20	18(note 1 & 3)
50" thru 60"	18	18(note 2 & 3)

Notes:

1. Reinforce with 1"x1"x1/8" girth rings every 6 feet.
2. Reinforce with 1 1/4" x 1 1/4" x 3/16" girth rings every 4 ft.
3. When companion flange joints are used as reinforcement, 44" to 48" diameter shall be 2"x2"x3/16" and 50" to 60" diameter shall be 2 1/2"x2 1/2" x 3/16".

D. Manufacturers

1. All spiral duct fittings shall be as manufactured by SEMCO Incorporated or approved equal.

2.5 INSULATED DUAL WALL SPIRAL DUCT AND FITTINGS

A. General

1. All round and/or flat oval spiral duct and fittings shall be manufactured by a company whose primary business is the manufacture of spiral duct and fittings and who has been in business for at least ten (10) years. All spiral duct and fittings shall be manufactured by the same firm and shall be as shown on the contract drawings.
2. All spiral duct and fittings shall be manufactured from G-60 galvanized steel meeting ASTM A924 and A653 requirements, and shall have double wall construction with internal 1" fiberglass insulation, perforated galvanized liner, and exterior prime coat finish.

B. Construction

1. Branch connections shall be made with 90° conical and 45° straight taps as shown on the drawings. All branch connections shall be made as a separate fitting. Factory or field installation of taps to spiral duct shall not be allowed without written approval of the engineer. Manufacturer's published individual fitting performances shall be on file with the design engineer ten (10) days prior to bid.
2. All elbows shall be fabricated with a centerline radius of 1.5 times the diameter. 90° and 45° elbows in diameters 3" round through 10" round shall be stamped or pleated elbows. All other elbows shall be of the gored type, fabricated in accordance with the following:

<u>DEGREE OF ELBOW</u>	<u>NUMBER OF GORES</u>
less than 36°	2
37° thru 71°	3
72° thru 90°	5

Where it is necessary to use two-piece mitered elbows, they shall have a minimum number of vanes in accordance with the following:

<u>DUCT DIAMETER</u>	<u>NUMBER OF VANES</u>
3" thru 9"	2
10" thru 20"	3
21" and up	5

3. Circumferential and longitudinal seams of all fittings shall be a continuous weld or spot welded and sealed with mastic. All welds shall be painted to prevent corrosion.
4. All field joints up to and including 60" shall be made with a 2" slip-fit or slip coupling. Diameters 62" round and larger shall be joined with 2"x2"x3/16" Vanstone flanges for fittings and solid welded flanges for spiral duct.
5. Proprietary connectors such as manufactured by Ductmate or AccuFlange may also be used in lieu of slip connections or angle flanges.
6. Access doors shall be supplied by the duct manufacturer at all fire and/or smoke dampers.
7. All flanges and access doors shall be factory installed. Shipments of loose flanges, access doors or taps for field installation into spiral duct will not be allowed.
8. The spiral duct shall be double wall and shall be constructed of an outer shell, a 1" thick layer of fiberglass insulation, and an inner metal liner. Insulation shall have a thermal conductivity "K" factor of .26 BTU/hr./sq.ft/°F or less.
9. The inner metal liner for all spiral and longitudinal seam duct shall be perforated metal. All fittings from fan discharge to a point where 35 lineal feet of spiral duct has been used shall have a perforated metal liner. All other fittings shall have a solid metal liner which may be one even gauge lighter than that shown for perforated liners.

C. Metal Gauges

1. Metal gauges for dual wall round ducts shall be as follows:

a. Round ducts with maximum 2" W.G. positive static pressure

<u>INSIDE DIAMETER</u>	<u>SPIRAL DUCT</u>		<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>	
	<u>SHELL</u>	<u>PERF. LINER</u>	<u>SHELL</u>	<u>PERF. LINER</u>
3" thru 8"	26	26(non-ribbed)	24	24
9" thru 24"	26	26(ribbed)	24	24
26" thru 34"	24	26(ribbed)	22	24
36" thru 48"	22	26(ribbed)	20	22
50" thru 58"	20	26(ribbed)	18	22
60" thru 62"	18	26(ribbed)	16	22
62" thru 76"	18	22(non-ribbed)	16	22

b. Round ducts with maximum 2" W.G. negative static pressure.

<u>INSIDE DIAMETER</u>	<u>SPIRAL DUCT</u>		<u>FITTINGS AND LONGITUDINAL SEAM DUCT</u>	
	<u>SHELL</u>	<u>PERF. LINER</u>	<u>SHELL</u>	<u>PERF. LINER</u>
3" thru 8"	26	26(non-ribbed)	24	24
9" thru 15"	26	26(ribbed)	24	24
16" thru 20"	24	26(ribbed)	22	24
22" thru 24"	22	26(ribbed)	20	24
26" thru 28"	22	26(ribbed)	18	24
30" thru 32"	20	26(ribbed)	18	24
34" thru 40"	20	26(ribbed)	16	22
42" thru 46"	20	22(non-ribbed)	18(see notes)	22
48" thru 58"	18	22(non-ribbed)	18(see notes)	22

Notes:

1. Reinforce with 1"x1"x1/8" girth rings every 6 feet.
2. When companion flange joints are used as reinforcement, 44" to 48" diameter shall be 2"x2"x3/16" and 50" to 60" diameter shall be 2½"x2½" x 3/16".

D. Manufacturers

1. All spiral duct fittings shall be as manufactured by SEMCO Incorporated or approved equal.

2.6 CASINGS

- A. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed. Construct for not less than 6" w.c. unless otherwise noted on drawings.
- B. Mount floor mounted casings on concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage

galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

- C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
- D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage back facing and 22 gage perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb/cu ft minimum glass fiber media, on inverted channels of 16 gage.

2.7 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
 - 1. Less Than 12 Inches Square: Secure with sash locks.
 - 2. Up to 18 Inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 x 48 Inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.8 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.9 EQUIPMENT FLEXIBLE DUCT CONNECTIONS (To air moving equipment.)

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 3 inches wide.
 - 3. Metal: 3 inch wide 24 gage galvanized steel.

2.10 FLEXIBLE INSULATED DUCTS

- A. All flexible ducts used to connect diffuser, grilles, etc. shall be similar to Flexmaster USA, Inc.; Type #3. Flex duct shall be insulated type consisting of a factory fabricated assembly of a trilaminate of aluminum foil, fiberglass and polyester. It shall be mechanically locked without adhesive into a formed aluminum helix on the ducts outside surface and shall withstand a minimum 6" w.c. operating pressure. The duct material shall be factory wrapped in a thick blanket of fiberglass insulation with a "C" factor of .25 or less. The insulation shall be encased in a fire retardant polyethylene protective vapor barrier with a perm rating of not over 0.1 grains per square foot per hour per inch of mercury. The flexible duct shall be constructed in accordance with and be listed as UL 181 Class I air duct and comply with NFPA 90A and 90B and have a flame spread of not over 25 and a smoke developed of not over 50. The flexible duct shall have a minimum pressure rating of 12" w.c. through a temperature range of -20°F to 250°F. Flexible duct shall be UL rated.
- B. Maximum length of flexible duct shall be 5'-0" to each outlet unless indicated otherwise on drawing.
- C. Flexible duct shall be installed without bends unless so indicated on drawing.

2.11 DUCT SPIN-IN FITTINGS

- A. Low pressure spin-in fittings (take-offs from main duct to flexible duct) shall be similar to Flexmaster USA, Inc. Model CB-D conical bellmouth fitting with damper and positive locking wing nut. Edges of the take-off opening in the duct shall be sealed with fire retardant duct sealer.

2.12 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension, steel construction, with individually adjustable blades and mounting straps.

2.13 BACKDRAFT DAMPERS.

- A. Gravity Backdraft Dampers, Size 18 x 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage thick galvanized steel with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.14 FIRE, SMOKE AND COMBINATION FIRE/SMOKE DAMPERS

- A. Fire dampers shall be fabricated in accordance with NFPA 90A and UL 555. They shall have a minimum rating of 1½ hour, have a dynamic closure rating of 3,000 fpm and 6" wg and be so identified with a UL label. Smoke dampers shall be fabricated in accordance with NFPA 90A and UL 555S with same rating as fire

damper and be so identified with a UL label. Smoke damper shall be opposed blade type, normal functions to close automatically and opened by a factory installed electric actuator. A smoke damper may also be a fire damper if it's location lends itself to the multiple functions and it meets the requirements of both.

- B. Provide factory sleeve and collar for each damper.
- C. Operators: Factory installed UL listed and labeled spring closed motorized open, electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.
- D. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro-thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro-thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- F. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side with locking clip.
- G. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- H. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations and closure under air flow conditions. Configure with blades out of air stream.
- I. Fusible Links: Listed for 165 degrees F unless higher or lower temperature rating is required. Contractor shall verify usages and ratings for fusible link temperature rating.

2.15 VOLUME CONTROL DAMPERS.

- A. Provide balancing dampers on all duct take-offs to diffusers, grilles and registers; at points on supply, return and exhaust systems where branches take off from larger ducts, as required for air balancing (install damper a minimum of 2 duct widths from take-off; as required by balancing agency; and where indicated on drawings. Where access to dampers cannot be achieved, access panels shall be installed. If access panels are not preferred, remote dampers shall be installed. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed. All dampers shall have a locking device per SMACNA Standards, to hold the damper in a fixed position without vibrating.
- B. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- F. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.16 ROOF CURBS

- A. The mechanical trades shall be responsible for furnishing and setting in place all mechanical equipment, roof curbs and piping/duct roof curbs. The general trade shall be responsible for the roof work and associated flashing. The mechanical trade shall furnish and install treated wood base blocking as required to level curb and to match roof insulation thickness. Curb shall be as specified, or if not specified should be similar to Pate or Thy-curb with heavy gauge galvanized steel, insulated and with wood nailer. Height of curb scheduled or specified shall be height required to top of curb above finished roof. If height is not specified or noted, a minimum 12" high above finished roof will be required. (pipe support units shall be at height required). Rooftop units will be shipped knocked down with the mechanical trade responsible for assembly on site. Roof curb shall mate with unit and provide support and a watertight installation.

2.17 EXHAUST FANS

- A. See schedules on drawings and furnish all.

2.18 DIFFUSERS AND GRILLES

- A. See schedules on drawings and furnish all.

2.19 LOUVERS

- A. See schedule on drawings and furnish all.

2.20 KITCHEN HOOD EXHAUST DUCTWORK

- A. Fabricate in accordance with SMACNA HVAC Duct Construction, Standard Michigan Mechanical Code, and NFPA 96 as a minimum. Ducts shall pitch down back toward hood a minimum of 2% slope (.25" per ft.) Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed.
- B. Exhaust duct from a Class I kitchen hood shall be constructed of 16 gage carbon steel or 18 gage stainless steel, using continuous external welded joints. Cleanouts shall be provided on ductwork at all changes in direction. Duct shall be enclosed as follows:
 - 1. Kitchen hood exhaust duct enclosure shall consist of a 22 gauge sheet metal enclosure on 1" thick mineral wool batts or ceramic fiber blanket reinforced with blanket reinforced with wire mesh or equivalent, spaced out 1" from exhaust duct on non-combustible spacers, or shall be wrapped with two layers of "Fyre Wrap" by Unifrax or similar, installed as recommended by manufacturer and approved by the Fire Marshall. Refer to Section 15270 of these specifications. The enclosure system shall be furnished and installed in accordance with NFPA 96.
- C. Exhaust duct from a Class II kitchen hood, such as serving a dishwasher, shall be constructed of 18 gauge carbon steel or 20 gauge stainless steel, using continuous external welded joints.

2.21 KITCHEN HOOD

- A. Vertical air curtain design shall be in wall, single island or double island models. The ventilator shall be a modified double shell design, constructed of 18 ga. 300 series stainless steel. Stainless steel shall be of U.S. manufacture, and shall meet U.S. standards for gauge, thickness and alloy composition. The ventilator shall be U.L. listed/classified and shall be designed to introduce replacement supply air vertically along the front edge of the ventilator in a quantity equal to at least 78% of the volume of air to be exhausted. The velocity at the air slot shall not exceed 300 FPM. The supply air slot shall not be equipped with registers, linear bar diffusers, balancing dampers or any other device meant to restrict full airflow at air outlet. Directional louvers may be added as optional equipment in the air slot to provide directional supply air flow, as required.
- B. The supply air plenum shall have fixed aluminum perforated metal air distribution baffles, to insure equal distribution of supply air along entire length of the supply air slot. the supply air plenum shall also contain an air inlet collar, complete with U.L. Listed fire damper per requirements of NFPA 96.
- C. The design exhaust CFM of the ventilator shall be sized per manufacturer's UL certification for test performance for high heat/high grease application. The combined airflow designs shall be verified by Underwriters Laboratories test results and manufacturer's listing requirements.
- D. The ventilation canopy shall contain, as standard features, the following:

1. All stainless steel construction. All surfaces, exposed or non-exposed shall be stainless steel.
 2. Continuous welded external seams and corners, ground and polished to match adjacent metal finish.
 3. A full complement of UL classified aluminum baffle type grease filters.
 4. Stainless steel grease trough and grease cup, removable for easy cleaning.
 5. UL listed incandescent lights, pre-wired to junction box on top of ventilator and control switch.
 - a. Face mounted control panel - stainless steel, with pre-wired switch for ventilator lights and pre-wired switch for exhaust and supply fan, with indicator lights.
- E. Other electrical switches and indicator lights, as required, shall be mounted and pre-wired in the control panel and permanently labeled for function and operation mode. All switches and indicator lights shall terminate in junction boxes on top of ventilator and shall be color coded and number keyed using a terminal strip.
- F. All wiring shall be in conformance with the National Electrical Code and applicable UL requirements.
- G. All ventilators shall bear the UL label, NSF listing and BOCA Research Report No. 88-75.
- H. The ventilator shall conform to size and configuration as detailed on plans and shall meet performance requirements as scheduled and required by all local and state codes and requirements including description of ventilation systems for food service establishments issued by the Michigan Department of Public Health.
- I. Hoods shall be manufactured by Duo-Air and be series CAB - VAC type.
- J. Kitchen ventilation canopies of other manufacturer's differing in any aspect from this specification must be submitted for review and prior approval at least two (2) weeks prior to bid date, except that no manufacturer's ventilator shall be accepted if it deviates from the materials/construction requirement listed under "standard features".
- K. Hood manufacturer shall furnish stainless steel trim and panels as required to extend hood to ceiling on all sides. Trim shall match hood finish and stainless steel.

PART 3 EXECUTION

3.1 DUCT INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed. Note: All ductwork joints, fittings, etc. shall be sealed.

- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork for pitot tube where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Slope underground ducts to plenums or low pump out points at 1/8" per foot. Provide access doors for inspection.
- I. Tape joints of PVC coated metal ductwork with PVC tape.
- J. Insulate buried supply duct runs with two inch thick insulation styrofoam covered with plastic vapor barrier.
- K. Connect flexible ducts to metal ducts mechanically without adhesives. Connect outlets to low pressure ducts with flexible duct held in place with strap or clamp.
- L. Coordinate duct locations with available space, route ducts around obstructions as required, and review duct changes with Engineer, all before starting construction.
- M. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- N. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.
- O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- P. Install manual balancing dampers in ductwork at all branch take-offs, all diffuser and grille take offs, etc.
- Q. Install roof exhaust fans on minimum 18" high roof curbs but not less than 12" higher than parapet walls within 10'-0" of fan.

3.2 DUCT CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect

equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.3 SMOKE AND FIRE DAMPER PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.4 FIRE DAMPER, ACCESS DOOR AND FLEXIBLE DUCT INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible for 6" pressure duct system as a minimum. Where requirements are specified in this specification, or noted on drawings above the minimum SMACNA Standards, the more stringent specified and noted requirements and practices shall be followed.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 12x12 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated unless limited by duct size.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges in accordance with NFPA 92A and the latest edition of "SMACNA State Fire Marshal, Fire and Smoke Damper Clarification" manual as published by SMACNA.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

- K. Provide balancing dampers where recommended by balancing agency.

3.5 DIFFUSER AND GRILLE INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, grilles and registers, whether dampers are specified as part of the diffuser, grille or register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black.
- F. Diffuser/grille color shall be selected from the full range of manufacturer available colors and finishes.

3.6 UNIT HEATER STACK AND BREECHING INSTALLATION

- A. Unit heater stack and breeching shall be installed in accordance with the manufacturer's installation instructions and shall meet all applicable codes and standards.

3.7 WATER HEATER STACK AND BREECHING

- A. Water heater stack and breeching shall be installed in accordance with the manufacturer's installation instructions and shall meet all applicable codes and standards.

3.8 KITCHEN HOOD

- A. The kitchen hood shall be installed per manufacturer recommended installation instructions and to meet all Michigan Department of Public Health requirements and codes as well as all local requirements and codes.
- B. Hood manufacturer will be responsible for any and all hood modifications required to meet all tests after installation such as the "smoke test" and any other tests or requirements of the Health Department.

END OF SECTION

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SECTION 23 74 00

ROOFTOP HVAC UNIT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Rooftop HVAC unit and accessories.

1.2 REFERENCES: Material and/or equipment specified in this section shall meet or exceed one or more of the property requirements or installation requirements of the following specifications/publications as applicable to the specific product or end use:

- A. ARI 210 - Unitary Air-Conditioning Equipment.
- B. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- C. NFPA 70 - National Electric Code
- D. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- E. ANSI/ASHRAE 90A - Energy Conservation in New Building Design
- F. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

1.3 QUALITY ASSURANCE

- A. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on product offering.
- B. ISO 9001 Certification. The air handling manufacturer shall be ISO 9001 Certified by a third party registrar, such as HSB Registration Services, that is accredited by an accreditation body such as ANSI-RAB and / or RvC Dutch Council for Accreditation.
- C. Constant Volume Air Handling Units: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. If air handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.
- D. Variable Air Volume Air Handling Units with Variable Inlet Vanes: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. Certify units with inlet vanes in wide-open position. If air handling units are not certified in accordance with ARI 430, contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.

- E. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410-91.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.5 ACOUSTICS

- A. Manufacturer of packaged rooftop equipment shall provide Noise Criteria (NC) sound level data across all octave band center frequencies for cataloged operating range of unit at gross cooling capacity range. Data shall be obtained in conformance with ANSI S1.32-1980, American National Standard Methods for the Determination of Sound Power Levels of Discrete Frequency and Narrow Band Noise Sources in Reverberation Rooms and per AMCA Standard 300-85 test code "Sound Rating Air Moving Devices".

1.6 REGULATORY REQUIREMENTS

- A. Unit shall conform to ANSI/UL 465 for construction of packaged air conditioner and shall have U.L. label affixed to rooftop unit package. In the event the unit is not UL approved, the manufacturer shall, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform required modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

1.7 EXTRA MATERIALS

- A. Install new clean filters at end of project. Provide one extra set of filters for future use by Owner at completion of project.
- B. Furnish one extra complete set of fan motor drive belts.

1.8 WARRANTY

- A. A parts warranty for one year from date of start-up or 18 months from date of shipment, whichever comes first, shall be provided at no additional cost.

PART 2 PRODUCTS

2.1 ROOFTOP RTU

- A. Refer to drawings and furnish all.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure. Install roof mounting curb level.

3.3 MANUFACTURER'S FIELD SERVICES & WARRANTY

- A. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit.
- B. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.
- C. Furnish complete service and maintenance of units for one year from date of substantial completion.
- D. Furnish initial start-up and shut-down during first year of operation, including routine servicing and check-out. Furnish Owner's personnel training on operation and maintenance of rooftop unit.
- E. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- F. Submit copy of service call work order on report to the Owner, and include description of work performed.
- G. The Sheetmetal Trade shall be responsible for installation and wiring of all rooftop unit manufacturer furnished accessories such as the economizer, power exhaust fan, roof curb, etc. The Sheetmetal Trade shall verify all work required during bidding and include all costs in their bid.

END OF SECTION

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DIVISION 28 – ELECTRONIC SAFETY & SECURITY

28 46 13	Fire Alarm System

SECTION 26 00 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Basic electrical Requirements specifically applicable to Division 26 & 28 Sections, in addition to Division 1 - General Requirements.
- B. Information in this section is intended to clarify or make additions to the requirements set forth in the General Conditions, Supplementary Conditions and Division 1 of these specifications. Any conflict between Division 26 & 28 and those in the General Conditions or within the Division 26 drawings, Supplementary Conditions and Division 1 shall be brought to the attention of the Architect/Engineer in writing as a request for addendum prior to the bid opening.
- C. Furnish all equipment, materials, articles, items, operations or methods listed, mentioned or scheduled on drawings, these specifications, manufacturer's installation instructions and include all labor materials, equipment and incidentals necessary for complete installation and operation.
- D. All information contained in this section applies to all sections within Division 26 as it was part of each section.
- E. Final walk-thru. Electrical Contractor shall submit in writing to the Architect's office or the Construction Manager advising that all of the Division 26 & 28 work has been completed in accordance with the plans and specifications. The intent is to acknowledge the Contractor is ready for a walk-thru. Open items that are part of the required construction work should be completed prior to the final walk-thru to avoid developing a so called construction completion list. The engineer reserves the right to reschedule the final walk-thru as determined accordingly.
- F. Pre-bid questions. All pre-bid questions, clarifications, etc. must be submitted in writing to the Architect Office or the Construction Manager. All phone calls, faxes or e-mails from bidders and manufacturers, etc. directly received by the Engineers office during the bidding phase will be deferred back to the Architect Office or the Construction Manager.
- G. Electrical Contractor shall review all of the project plans and specifications and not rely solely on the electrical drawings to establish a project bid. Refer to the structural and mechanical drawings for final mechanical equipment locations. Mechanical drawings shall govern over the electrical drawing locations.
- H. Unit Pricing: Contractor shall furnish pricing as listed in the Bid Proposal Forms.
- I. The Contractor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$150.00 for the first plan, and \$50.00 for each additional plan that may be requested for

AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Contractor.

1.2 LAYOUT OF THE WORK

- A. Examine the site and all the drawings before proceeding with the layout and installation of this work. Verify all door swings and clearances to cabinets, etc., before locating switch and outlet boxes. Locate conduit, boxes, etc., essentially as shown on the drawings but in exact layout determined on the job to suit actual conditions. Confer and cooperate with the other trades on the job so all parts will be installed in proper relationship. Precise locations of parts to coordinate with other work is the responsibility of the Contractor.
- B. The Electrical Trades shall complete all cutting and patching for the electrical work, unless noted or specified otherwise. Division 26 & 28 Contractor shall be responsible to coordinate with the site Restoration Contractor for the new underground electrical work.
- C. Arrange exposed work as closely as practicable to wall or ceiling surfaces in an accurate alignment. Locate concealed work so fittings, connectors and other projections will clear surfaces. Exposed work is defined as non-finished spaces, such as mechanical/electrical rooms or as indicated on architectural room schedules. All finished spaces, installation shall be concealed. Refer to Architectural drawing for room finish schedules.
- D. During the bidding phase, if any design or discrepancy issues are discovered between the electrical drawings, specifications and other project plans, the contractor shall notify the Architect/Engineer. The intent is to resolve any issues during the bidding phase. For pertinent issues, addendums will be issued accordingly. After entering into a contract, it shall be considered there are no identified conflicts.
- E. No drilling of existing laminated beams for new work is permitted without review with the project Structural Engineer

1.3 INTERFERENCES

- A. The Electrical Contractor shall examine the plans of mechanical trades, the architectural and structural drawings and shall notify the Architect/Engineer to resolve such interference or discrepancy. The Electrical Contractor bid shall not be based solely on the Electrical Plans and Specifications. Contractor shall obtain and review all project documents. The Contractor, when directed, shall make such changes or off-sets as required so that the work shall be properly located and coordinated with the other trades. Failure to comply with the foregoing will not relieve contractor's responsibilities of making such changes. Such changes shall be completed at no additional cost to the Owner.
- B. All changes in location of equipment, fixtures, distribution equipment, receptacles, etc., from those shown on plans, shall be made without charge when directed by the Architect/Engineer before installation. At this time, an agreement shall be made if such a change is an additional cost to the owner.

- C. The Electrical Contractor shall confer with other trades regarding location and size of pipes, equipment, fixtures, conduit, duct openings, switches, outlets, etc., in order that there may be no interference in the installation of the work of any trades or delay in the progress of any work.
- D. The Electrical Contractor shall be responsible for confirming final receptacle, data, and switch heights at countertop and casework locations with the architectural details. Architectural details shall govern final locations and mounting heights. Failure to coordinate will not relieve the contractor of making changes as required, at no cost to the owner.
- E. Any changes made, necessary through failure to make proper arrangement to avoid interference, shall not be considered as extra.
- F. The Electrical Contractor shall cooperate with those performing work under other divisions in his preparation of interference drawings, to the extent that the location of plumbing piping, heating piping, and/or ventilation ducts, with respect to the installation of other trades, shall be mutually agreed on by those performing work under other divisions.
- G. In the event the described work on the drawings doesn't match requirements described in the specification, the more stringent shall be provided.
- H. Electrical Contractor shall review the Architectural drawings for work station, casework details and section drawings that show raceway details. Furnish the raceway as noted and detailed.
- I. Contractor shall carefully review the Code sections pertaining to safe working clearances to avoid piping, ducts interferences and other equipment. Install the electrical equipment to meet Code requirements. Adjust the locations shown as required.

1.4 TRENCHING AND RELATED UNDERGROUND WORK

- A. The Electrical Contractor shall contact "811" 72 hours prior to any excavation to locate existing underground utilities. Pay all costs to obtain the services of a specialty utility service company to locate all private utilities as required.
- B. Prior to any actual trenching, Electrical Contractor shall review the utility maps; shall visually observe and review the intended routing for above and below ground obstruction; shall confer with the appointed field representative, and shall establish preliminary location for trenching.
- C. After this routing is established, Contractor shall hand dig in areas of obstructions where powered equipment is non-accessible.

1.5 MATERIALS AND WORKMANSHIP

- A. All materials and equipment furnished for installation on this project shall be new and in strict accordance with this specification. All packaged materials shall be delivered in the original containers which show the manufacturer's name and the

identifying designations as to size, quality, etc. Materials delivered to the job in unmarked or mutilated packages will be immediately inspected by the Contractor. Materials or equipment judged as "damaged" by the Contractor's own inspection shall be immediately addressed with the supplier. All electrical equipment shall bear the Underwriter's Label.

- B. All work shall be performed in a professional manner under the supervision of the electrical project manager. The project manager shall be considered the main point of contact for the Architect/Owner's daily communication.
- C. Should any dispute arise as to the quality or fitness of the materials or workmanship, Architect, Owner, Engineer and Electrical Contractor shall mutually agree work is non-acceptable and shall be reworked at no additional cost to the Owner.
- D. Division 26 & 28 equipment schedule descriptions shall govern if it is found that the manufacturer's catalog numbering shown on the drawing is not current, or changed by the manufacturer without notification. Division 26 & 28 Contractor shall notify the Architect/Engineer with any conflicts during the bidding phase to get clarifications. After entering into a Contract, it shall be considered the equipment schedules provide the information to meet the intended specifications for quality and performance.

1.6 GUARANTEES

- A. All equipment and work performed under Division 26 & 28 shall be guaranteed for one (1) year from time of substantial completion of project, unless directed otherwise in Division 1.

1.7 VOLUNTARY ALTERNATES

- A. The Architect/Engineer will only accept voluntary alternate as a bid deduct. Alternate must maintain the same level of quality to meet the design intent. Voluntary alternates must be submitted with the bid for review by the Owner. Failure to comply will be no reason to accept any voluntary alternates after entering into a contract.

1.8 OWNERS ACCEPTANCE OF EQUIPMENT

- A. Refer to Division 1.
- B. Upon the Owner's written acceptance, the Electrical Contractor's guarantee period shall begin and the Owner shall accept the responsibility for operation and maintenance and the Contractor's liability shall be limited to the conditions covered in the guarantee as described in these specifications.

1.9 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.10 SUBMITTALS

- A. Submit electronic shop drawing files.
- B. Proposed Products List: Include Products specified in the following Sections:
 - 1. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables
 - 2. Section 26 09 23 - Lighting Control Devices
 - 3. Section 26 24 16 - Panelboards
 - 4. Section 26 27 26 - Wiring Devices
 - 5. Section 26 28 16 - Enclosed Switches and Circuit Breakers
 - 6. Section 26 32 00 - Packaged Generator Assembly
 - 7. Section 26 51 00 - Interior Lighting
 - 8. Section 26 56 00 - Exterior Lighting
 - 9. Section 28 46 13 - Fire Alarm System
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in single submittals.
- D. Mark dimensions and values in units to match those specified.
- E. Shop drawings shall be reviewed and checked by the Electrical Contractor for specification compliance prior to release for the Engineer's review. Failure to comply will be no cause or reason for additional costs to the Owner with project delays.
- F. Electrical distribution submittal shall include cut sheets for each piece of equipment. Written description is not acceptable.
- G. Bill of materials shall be submitted as part of O&M Manual. Bill of Materials is not considered a shop drawing.

1.11 REGULATORY REQUIREMENTS

- A. Conform to applicable Building Code.
- B. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- C. Equipment: U.L. tested and approved for its purpose.
- D. The Electrical Contractor shall obtain and pay for all permits and inspection fees. Provide the Owner with final inspection documents from authorities having jurisdiction.
- E. State of Michigan, Bureau of Fire Services for Emergency Lighting and Fire Alarm Plan Review.

- B. Equipment: Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- F. Life Safety NFPA 101 – The State of Michigan current adopted edition.
- G. Fire Alarm Code NFPA 72 – The State of Michigan current adopted edition.
- H. 2021 Michigan Energy Code.
- I. ASHRAE 90.1 2019 Edition.

1.12 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on drawings, unless prevented by project conditions.
- B. All bidders shall personally inspect the site and acquaint themselves with all existing conditions involved in execution of this contract, and make all necessary measurements. No “extra” will be considered for additional work required because of bidder’s failure to do so.
- C. Arc flash warning labels. Provide arc flash generic warning labels in accordance with 2023 NEC Section 110 requirements.
- D. Provide PPE arc flash warning labels as specified with arc flash/short circuit coordination study

1.13 TEMPORARY SERVICES

- A. Division 26 Trades shall provide and maintain wiring for all interior construction lighting and power to meet OSHA Standards. Division 26 Trade shall provide and maintain all required lamps and guards. Contractor’s power tools, cords, etc. shall be in strict accordance with National Electrical Code 2023, Article 590.
- B. Electrical Contractor shall pay for all temporary internet and power for their office and or construction trailer.
- C. Electrical Contractor shall be responsible to review Division 1 requirements to provide project temporary lighting and power requirements for the construction and demolition phases.

1.14 RECORD DRAWINGS

- A. The Electrical Contractor shall furnish as-constructed drawings, including all Addendums, Bulletins and associated Field Directed Changes included as part of the record drawings.

1.15 OPERATION AND MAINTENANCE MANUALS

- A. Verbal instruction and written operational instructions are to be given on all equipment and systems under this contract. A time is to be scheduled with the Architect/Engineer and Owner for these instructions and a time submitted in writing for instructions at the facility.
- B. Two (2) bound sets of Operating and Maintenance Manuals are to be submitted to the Architect/Engineer for approval. Manuals are to include complete parts list and maintenance procedures as well as operating instructions on all equipment supplied under Division 26 & 28.

END OF SECTION

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SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes basic electrical requirements, which are applicable to all Division 26 sections.

1.2 REGULATORY REQUIREMENTS

- A. Conform to requirements of the applicable:
 - 1. Michigan Building Code
 - 2. National Fire Protection Association 70, 2023 National Electrical Code
 - 3. 2023 State of Michigan Electrical Code Rules Part 8
 - 4. 2017 ICC/ANSI A117.1
 - 5. Local Codes
 - 6. National Fire Protection Association 101, Life Safety Code
 - 7. National Fire Protection Association 72, Fire Alarm Code
 - 8. Other applicable National Fire Protection Association Codes
 - 9. State of Michigan Uniform Energy Code.

1.3 WORKMANSHIP

- A. Should any dispute arise as to the quality or fitness of the materials or workmanship, Engineer, Owner and Electrical Contractor shall mutually agree Work is non-acceptable and collaborate on an agreeable solution.
- B. All Division 26 Work shall be done under the direction of a currently licensed State of Michigan Master Electrician. All Work shall be provided in a professional manner.

PART 2 PRODUCTS

2.1 GENERAL PRODUCTS

- A. All Products, shall be listed by and shall bear the label of an approved Nationally Recognized Testing Laboratory (NRTL) as identified by the United States Occupations Safety and Health Administration (OSHA), per the OSHA Nationally recognized Testing Laboratory Program. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by the owner, shall apply and such items shall bear those labels here one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, shall be so labeled.
- B. Where Products are used which defer in arrangement, configuration, dimensions, ratings, or engineering parameters from these indicated on the contract documents, the contractor is responsible for all costs involved in integrating the

equipment or accessories into the system and the assigned space, and for obtaining the performance from the system into which these items are placed.

- C. Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.
- D. All Products provided for installation on this project shall be new and in strict accordance with this specification. All packaged material shall be delivered in the original containers which show the manufacture's name and the identifying designations as to size, quality, etc. Material delivered to the Project in unmarked or mutilated packages will be ordered to be removed from the site at once. Materials or equipment judged as "damaged" by the Owner or Engineer shall be removed from the Project. All electrical equipment shall bear the Underwriters Label.
- E. All materials, shall be listed by and shall bear the label of an approved Nationally Recognized Testing Laboratory (NRTL) as identified by the United States Occupations Safety and Health Administration (OSHA), per the OSHA Nationally recognized Testing Laboratory Program. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by the owner, shall apply and such items shall bear those labels here one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, shall be so labeled.
- F. Divisions 26 Product schedule descriptions shall govern if it is found that the manufacture's catalog numbers as shown on the Drawings are not current or changed by the manufacturer without notification. Divisions 26 contractor shall notify the Engineer with any conflicts during the bidding phase to get clarifications. After entering into a Contract, it shall be considered the equipment schedules provide the information to meet the intended specification for quality and performance.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine the site and all the Drawings before proceeding with the layout and installation of this Work. Verify all door swings and clearances to cabinets, etc., before locating devices, boxes support Etc. Locate conduit, boxes, etc., essentially as shown on the drawings but in exact layout determined on the job to suit actual conditions. Confer and cooperate with the Owner and other trades performing Work on site so all parts will be installed in proper relationship. Precise locations of parts to coordinate with other Work is the responsibility of the Contractor.

3.2 TEMPORARY SERVICES

- A. Division 26 trades shall provide and maintain wiring for all interior construction lighting and power to meet OSHA standards. Division 26 Trade shall provide and

maintain all required lamps and guards. Contractor's power tools, cords, etc. shall be in strict accordance with e National Electric Code 2023 Article 590.

3.3 POWER OUTAGES

- A. No power outages shall be permitted on existing systems except at the time and interval specified by the Owner/Engineer. The Owner may require written approval, any outage must be scheduled when the interruption causes the least interference with normal schedules and business routines. NO extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.
- B. The Contractor shall provide a detailed outage plan and conduct outage planning meetings with the Owner/Engineer in preparation for the outage.
- C. The Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

3.3 RECORD DRAWINGS

- A. The Electrical Contractor shall furnish as-constructed drawings, including all Addendums, Bulletins and associated Field Directed changes included as part of the record drawings.

END OF SECTION

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SECTION 26 05 05

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Electrical demolition per plans and specifications.
- B. Conduit supports.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Electrical Contractor shall examine the project documents and visit the site as they deem necessary prior to submitting a bid. Do not rely solely on the Electrical Plans for all demolition requirements. Review all Project Documents prior to submitting a bid.
- B. The demolition information is provided to assist with labor costs associated with the electrical systems removal. The Electrical Contractor shall be responsible to confirm all quantities and the information provided.
- C. Upon removal of the existing ceiling, the Electrical Trades shall immediately notify the construction manager, Architect and Engineer in writing regarding existing conduits scheduled to remain that are not properly supported. Conduit evaluation shall be conducted with the Owner, Architect and Engineer. Failure for the Electrical Trades to submit a written conduit support condition will obligate the trade to support the conduits to meet current Code methods at no additional cost to the Owner.

3.2 PREPARATION

- A. Confirm with the Architect's Office and/or Construction Manager Project Schedules and review the Architectural, Structural and Mechanical drawings prior to commencing demolition.

3.3 DEMOLITION

- A. As noted or shown on the demolition plans, remove lighting, receptacles, switching, associated conduit, and surface raceway. Remove the fire alarm system as noted or shown or shown on the drawings. Use care during the demolition phase to avoid damage or any glazed block, tile or brick veneered walls. Electrical Contractors are responsible to confirm all quantities and information provided.
- B. Mechanical trades or BAS Contractor shall remove all associated temperature components, and associated conduit and wiring.
- C. Electrical Trades shall remove all existing fire alarm devices and associated conduits and surface mounted raceways. Patch to match.
- D. Electrical Trades shall transport all of the electrical salvaged materials to the Owner and include all transportation costs.
- E. As noted or shown on the demolition plans, remove all of the existing non-metallic type surface raceway or surface metal conduits noted or specified to be removed. Contractor shall also be responsible to review the architectural, structural and mechanical demolition drawings for associated electrical demolition work. Do not rely solely on the electrical drawings for bid submitted.
- F. Remove all unused conduits and wiring serving lighting and power being removed from the finished ceiling space. Remove all abandoned low voltage cables from accessible portions in accordance with NEC Sections 760.25(A), 640(A), 645.3(A), 725.3(B), 770.3(A), 800.3(C), 820.3(A) and 830.3(A). Include costs in bid to walk the ceiling spaces with the Construction Manager and the Owner for visual assessment of abandoned cables.
- G. As noted or shown on the demolition drawings, remove the exterior light fixtures. Backbox in-fill shall be completed as part of the masonry upgrade unless noted otherwise.
- H. As noted or shown on the demolition plans, remove all existing exterior electric bells as noted on the drawings. The existing backbox in-fill shall be completed as part of the masonry upgrade.
- I. Electrical Contractors are responsible to confirm all demolition quantities. Make pre-bid site visit arrangements as deemed necessary.
- J. All security system removal and reinstallation shall be completed by the Owner.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Fire rated cables.
- C. Service entrance cable.
- D. MC cable
- E. Non-metallic "NM" sheath cable.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Routing shown on Drawings is approximate unless dimensioned. Field route as required to best suit Project Conditions.
- D. Where wire and cable routing is not shown, and only a load destination is shown, determine exact routing and lengths required.

1.5 COORDINATION

- A. Coordinate Work under provisions of Division 1.
- B. Determine required separation between cable and other work.

- C. Determine cable routing to avoid interference with other work.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 BUILDING WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70, Type THW, THHN/THWN, XHHW-2.

2.2 MC CABLE

- A. Factory assembled multiple insulated conductors enclosed in armor of interlocking metal corrugated sheath.
- B. Provide all clips and supports.

2.3 FIRE RATED CABLE

- A. RHH fire rated type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use stranded conductors for control circuits.
- C. Use conductor size not smaller than 12 AWG for power and lighting circuits.
- D. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.

- E. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
- F. Pull all conductors into raceway at same time.
- G. Protect exposed cable from damage.
- H. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- I. Use suitable cable fittings and connectors.
- J. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- K. Clean conductor surfaces before installing lugs and connectors.
- L. Splices are not permitted.
- M. All power wiring shall be installed in conduit. Low-voltage wiring shall utilize the channel trays-hooks or free-air method, or other cable management methods that meet industry standards as noted on the drawings. Conduit drops for fire alarm devices, card readers, power assisted doors, and voice/data outlets shall be required. Electrical Trades shall be responsible for coordinating with the Owner's low-voltage system and drawings for required raceway. Low voltage cables installed in accessible ceiling space need not to be in conduit. However, the cables must be properly secured to the ceiling structure.
- N. Refer to Section 26 09 23 for Occupancy Sensors wiring.
- O. Refer to Section 28 46 13 for Fire Alarm wiring.
- P. If the Electrical Trades Contractor elects, at their option, to combine homerun circuits installed in a single conduit, the derating 2023 NEC 310.15(b) Table must be utilized for allowable conductor ampacity values. If the derating method is utilized, then furnish and install properly derated cables and properly sized conduits to meet Code. Electrical Trades Contractor shall be responsible to obtain inspection from the Electrical Inspector and pay all supplemental inspection and/or requested plan review fees.
- Q. NEC Article 700 requires fire protection for Emergency System feeders. Provide feeders with a 2-hour fire rating to meet Code requirements.
- R. Shared neutrals for lighting and power circuits are not permitted.
- S. MC cable shall only be acceptable as the final connection to light fixtures installed in accessible ceilings. Maximum cable shall not exceed 12 feet. MC cable shall not be used for homeruns or feeders.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 26 05 53.

- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.4 FIELD QUALITY CONTROL

- A. Perform field inspection and testing to assure proper operation.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.
- D. Building foundation grounding.
- E. Earth ground resistance.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 PERFORMANCE REQUIREMENTS

- A. Resistance: Meet the NEC Code requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of grounding electrodes.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODE

- A. Material: Copper-clad steel or copper-weld type.
- B. Diameter: as scheduled on the drawings.
- C. Length: as scheduled on the drawings.

2.2 MECHANICAL CONNECTORS

- A. As scheduled on the drawings.

2.3 EXOTHERMIC CONNECTIONS

- A. As scheduled on the drawings.

2.4 WIRE

- A. Material: As scheduled on the drawings.
- B. Foundation Electrodes: Size to meet NFPA 70 requirements.
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site soil conditions before driving rod electrodes.

3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- C. Provide bonding to meet Regulatory Requirements.
- D. Provide supplemental and service entrance grounding in accordance with 2023 NEC Section 250. Refer to Table 250-66
- E. Equipment Grounding Conductor: Provide a separate grounding conductor for lighting and power circuits as noted or specified on the drawings.
- F. Bond the paralleled service entrance conduits in accordance with NEC 2023 Section 310.10 requirements.
- G. Complete the grounding conductor to the building foundation rebar in accordance with 2023 NEC 250-52 (3) requirements.

- H. As shown and noted on the drawings, provide ground conductor from the new addition's foundation rebar back to the building's main distribution panel service ground bar. Provide minimum #6 grounding conductor from the main electric distribution equipment to the data racks.
- I. Provide a ground mat for the utility transformer as noted and shown on the drawings.
- J. Provide a grounding electrode and conductor for the pad mounted emergency generator as shown and noted on the drawings.

3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

3.4 EARTH GROUND RESISTANCE

- A. Use a meter that is suitable to tests 3 and 4 pole fall of potential with and without stakes. The meter shall measure ground loop resistances using only clamps, one stake, or one clamp and stakes. The stake-less test method shall measure earth ground loop resistances for multi-grounded system using only current clamps.
- B. The meter shall be capable of reading out which stakes or clamps to connect for each test. The resistance measurement shall calculate at 55 hz. Meter shall include automatic frequency control to identify existing interferences.
- C. Basic ground resistance measurements as applicable:
 - 3 pole
 - 4 pole
 - Stake-less ground loop
 - 3 pole with current clamp
 - 4 pole with current clamp
- D. Measuring principle: current/voltage measurement methods for the resistance methods listed above.

END OF SECTION

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SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Conduit and equipment supports.
- B. Anchors and fasteners.
- C. Transformer pad.
- D. Generator pad.
- E. Light pole concrete base.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.

- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Use expansion anchors.
 - 2. Steel Structural Elements: Use beam clamps.
 - 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Use expansion anchors.
 - 6. Sheet Metal: Use sheet metal screws.
 - 7. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Attachments of electrical equipment to structural members are the responsibility of the installing trade. Structural members shall not be field cut, welded or otherwise modified without approval of the Architect/Engineer. Attachment to steel joist shall be made at panel points whenever possible. Structural members shall not be overloaded as a result of attachments. Attachment/equipment loading for all trades resulting in total load greater than an equivalent uniform 5 psf for any member shall be submitted to the Architect/Engineer for review. Electrical Trades are still responsible for design, layout, and fabrication and installation of electrical supports and support attachment methods. Electrical Trades shall submit attachment methods to the Structural Engineer for review.
- B. Install products in accordance with manufacturer's instructions.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.
- E. Do not use powder-actuated anchors.
- F. Do not drill or cut structural members without permission from Architect/Engineer.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- J. Construct generator and transformer concrete pad as detailed on the drawings.
- K. No drilling of laminated wood beams without structural engineer review.

- L. Construct light pole concrete base as detailed on the drawings.

END OF SECTION

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SECTION 26 05 33.13

CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Metal conduit.
- B. Flexible metal conduit.
- C. Liquidtight flexible non-metallic conduit.
- D. Electrical metallic tubing.
- E. Nonmetal conduit.
- F. Electrical nonmetallic tubing.
- G. Flexible nonmetallic conduit.
- H. Fittings and conduit bodies.
- I. MC Cable.
- J. Flexible metal conduit.

1.2 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.3 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.4 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.3 - Rigid Aluminum Conduit.
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- F. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- G. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- H. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.5 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

- A. Verify routing and termination locations of conduit prior to rough-in.
- B. Conduit routing shown is diagrammatic, field route conduit to avoid interferences.

1.9 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 CONDUIT REQUIREMENTS

- A. Minimum Size: $\frac{3}{4}$ inch unless otherwise specified.
- B. Underground Installations:
 - 1. Use Schedule 40 PVC conduit for general underground installation.
 - 2. Use Schedule 80 PVC conduit for heavy traffic areas.
- C. Outdoor Locations, Above Grade: Use rigid steel conduit.
- D. Wet and Damp Locations: Use rigid conduit or liquid-tight non-metallic flexible conduit.
- E. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use electrical metallic tubing.
 - 3. Use minimum $\frac{3}{4}$ " conduit for fire alarm drops.
 - 4. Use flexible metal conduit for final wiring connections to motors, VFD units, and light fixtures in accessible ceiling.

2.2 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: ANSI C80.5.
- C. Intermediate Metal Conduit (IMC): Rigid Steel.
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

- A. Description: Interlocked steel construction.
- B. Fittings: ANSI/NEMA FB 1.

2.4 LIQUID-TIGHT NON-METALLIC FLEXIBLE METAL CONDUIT

- A. Description: Type NM. Manufacturer with a spiral of rigid PVC embedded reinforcement with a flexible PVC wall.

- B. Compatible fittings.
- C. Use for wet or exterior location as final wiring connections to motors or electrical equipment, etc.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; set screw type.

2.6 NONMETALLIC CONDUIT

- C. Description: NEMA TC 2; Schedule 40 PVC.
- D. Fittings and Conduit Bodies: NEMA TC 3.

2.7 MC CABLE

- A. Corrugated steel tubing with integral conductors.
- B. Use MC cable as noted on the drawings and specified in Low Voltage Electrical Power Conductors & Cables Specification 26 05 19.
- C. MC cable is not permitted for homeruns or feeders or branch device drops.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install nonmetallic conduit in accordance with manufacturer's instructions.
- B. Arrange supports to prevent misalignment during wiring installation.
- C. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- E. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.
- F. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- G. Do not attach conduit to ceiling support wires.
- H. Arrange conduit to maintain headroom and present neat appearance.
- I. Route conduit parallel and perpendicular to walls or building centerlines.

- J. Route conduit installed above accessible ceilings parallel and perpendicular to walls. Install metal conduit sleeves or fire rated assembly in all fire rated wall as identified on the electrical or architectural life safety plans.
- K. Route conduit in and under slab from point-to-point.
- L. Do not cross conduits in slab.
- M. Maintain adequate clearance between conduit and piping.
- N. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- O. Cut conduit square using saw or pipecutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- S. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
- T. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints. Use a UL listed expansion joint. If expansion length exceeds the manufactured expansion fitting, the use of PVC coated metallic flexible conduit is an acceptable method.
- U. Provide suitable pull wire in each empty conduit except sleeves and nipples.
- V. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- W. Ground and bond conduit under provisions of Section 26 05 26.
- X. Identify conduit under provisions of Section 26 05 53.
- Y. Firestop the conduits passing thru fire rated walls. Electrical Contractor shall be responsible to review the Architectural Life Safety drawings for fire rated wall locations.
- Z. The control system contractor shall be responsible to adhere to the mechanical plans and/or temperature control system drawings to establish conduit routes.
- AA. Electrical Contractor shall be required to install new conduit (concealed) in all finished areas for the following, but not limited to: exit lights, light fixtures, receptacles, sensors, switching, fire alarm manual pull stations, horn/strobe unit and strobe units, etc. Saw cut, channel and patch the walls. Neatly saw cut all

existing brick veneer, glazed block or tiled areas to complete the new work. Firestop all conduits passing through fire rated walls, floors or separation barriers. Take the necessary steps to prevent chipping during the saw cutting and or wall channeling operation in the brick veneer, glazed tile or block areas. It shall be acceptable to install conduit from the opposite wall side to minimize brick veneer, glaze block or tile work. In non-finished spaces such as janitor closets, mechanical rooms, hub rooms, electrical rooms and storage rooms, conduit can be surface mounted. Provide flush mounted device boxes in all new wall construction as shown on the architectural drawings. Conduit drops or MC cable shall be concealed in the new walls and as noted and specified on the drawings.

- BB. All power, voice, data, fire alarm, occupancy sensor lighting wiring installed in exposed spaces shall be installed in conduit.
- CC. Low-voltage voice and data device conduit drops shall only be required to be extended into the accessible ceiling space.
- DD. Contractor shall provide separate raceway for the emergency power distribution system.
- EE. Electrical Contractor shall identify emergency power. Identify all of the junction box cover plates with panelboard source ID and circuit number(s). Provide engraved label. Handwritten on the junction box cover plate is not acceptable.
- FF. Provide conduit wall sleeves for low-voltage wiring installation as shown and noted on the drawings. Firestop the conduit openings. Use fire rated wireway as specified or noted on the drawings.
- GG. Multiple non-metallic conduit duct bank shall include top, intermediate and bottom PVC conduit spacers spaced on 60" centers.
- HH. Provide empty conduit for power assisted doors as noted and shown on the drawings.
- II. Provide empty conduit for security system as noted and shown on the drawings.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods consistent with facility standards or this project specification. Contractor is responsible to review the Architectural drawings to determine fire rated locations.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket or detail to match roof type specified.
- C. No drilling of the existing gym laminated beams is permitted without a review with the project Structural Engineer.

END OF SECTION

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SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall and ceiling outlet boxes.
- B. Pull and junction boxes.
- C. Fire alarm device boxes.
- D. Occupancy sensor boxes.
- E. Power assisted door boxes.
- F. Security system boxes.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- B. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 SUBMITTALS FOR REVIEW

- A. Provide submittal as listed in Section 26 01 00.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 BRANCH DEVICE BOXES

- A. Sheet Metal Outlet Boxes: Use 4" square stamped steel box with single gang device ring as general project requirement.
- B. Nonmetallic Outlet Boxes: NEMA OS 2. (Not permitted unless as noted on the drawing).
- C. Cast Aluminum Boxes: for exterior location use a single gang shallow box with thread hub connection. Provide gasketed cover by box manufacturer.
- D. Use masonry box in masonry walls.
- E. Use 4" octagon box for ceiling smoke detectors.
- F. Use in line non-metallic type box in non-metal surface raceway assembly as scheduled and detailed on the drawings.
- G. Elevator service pit box for the receptacle shall be NEMA 4 to meet State Elevator Code.

2.2 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes
 - 1. NEMA 1 enclosure for interior location.
 - 2. NEMA 3R or 4X for exterior location.
 - 3. Stainless steel for food service area.
 - 4. Non-metallic pull and junction boxes are not permitted for this project unless noted otherwise.

2.3 OCCUPANCY SENSORS

- A. Refer to the manufacturer for box requirements.

2.4 PUBLIC ADDRESS AND TELEVISION DISTRIBUTION SYSTEM

- A. Refer to Sections 26 06 50 and 27 13 33.

2.5 VOICE AND DATA BOXES

- A. Use 4 11/16" square stamped steel box with a single gang device.

2.6 POWER ASSISTED DOOR BOXES

- A. Provide 4" square box for palm button backbox for use by the installing vendor.

2.7 SECURITY BOXES

- A. Provide empty 4" square boxes as noted and shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in locations as shown on Drawings, and as required for wire pulling, equipment connections and compliance with regulatory requirements.
- B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
- D. Orient boxes to accommodate wiring devices oriented as specified in Section 26 & 28.
- E. Maintain headroom and present neat mechanical appearance.
- F. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- G. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- H. Install boxes to preserve fire resistance rating of partitions and other elements.
- I. Coordinate mounting heights and locations of outlets for counters, backsplashes, benches in casework and workstations.
- J. Locate outlet boxes to allow luminaires positioned as shown.
- K. Align adjacent wall mounted outlet boxes for switches, etc.
- L. Use flush mounting outlet box in finished areas. Surface mounted boxes are acceptable for non-finished spaces.
- M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- P. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

- R. Use adjustable steel channel fasteners for hung ceiling outlet box.
- S. Do not fasten boxes to ceiling support wires.
- T. Support boxes independently of conduit.
- U. Use gang box where more than one device is mounted together. Do not use sectional box.
- V. Use gang box with plaster ring for single device outlets.
- W. Install floor boxes flush with the finished floor.
- X. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations. Set floor boxes level.
- Y. Install in line boxes in the surface mounted raceway system as shown on the drawing.
- Z. Large Pull Boxes: Provide screwed cover or hinged enclosure in interior dry locations as noted or specified on the drawing.
- AA. Junction box cover plates installed above the ceiling shall be facing down.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for equipment connected under other sections.
- B. Refer to Section 28 46 13 for fire alarm mounting height.

3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.
- D. Labeling methods and standards.
- E. Conductor color coding and identification.
- F. Panelboard directory.
- G. Underground warning tape.
- H. Arc flash warning labels.
- I. Voice/data faceplates and data rack patch panel ports.
- J. Electrical distribution equipment.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates:
 - 1. Engraved three-layer laminated plastic, black letters on white background for normal power.
 - 2. Emergency power panels and associated equipment shall be white letters on red.
- B. Locations:
 - 1. Each electrical distribution panelboard, switchboard and power panel.
 - 2. Each starter.
 - 3. Each disconnect.
 - 4. Automatic transfer switches.
 - 5. Emergency circuit junction box cover plates.
 - 6. MDF/IDF patch panel ports.
 - 7. Voice/data outlets.
 - 8. Each VFD.
- C. Nameplate size minimum 1"x3" or match existing.

2.2 WIRE MARKERS

- A. Manufacturers:
 - 1. Brady or equal.
- B. Description: Tape type wire markers.
- C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- D. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Control wire numbers.

2.3 CONDUIT MARKERS

- A. Emergency raceway or specialty systems.
- B. Location: Furnish stencil or painted stripe for each conduit longer than 10 feet. Stencil painted stripe shall not be less than 10" long (i.e. red or black).
- C. Spacing: 20 feet on center.
- D. Color:

1. 120, 208 or 480 Volt Normal Power System: Black.
2. 120, 208 or 480 Volt Emergency Power Supply: Red.

E. Legend:

1. Normal Power Supply Panel Feeder: Indicate panel being fed and from where. (LPM fed from DP4)
2. Emergency Power Supply Panel Feeder: Emergency Power Supply LS, CB, EB respectively. (i.e. LSIA, CBIC, EBDP)

2.4 LABELING METHODS AND STANDARDS

A. Engraved Labels

1. All electrical panels, starters, disconnect switches, terminal cabinets, fire alarm panel, or similar central system cabinet shall be permanently identified using engraved labels. These labels shall be secured with double face type or mechanically fastened in applications where the tape may have a tendency to fail.
2. Normal power fed systems shall have white labels with black lettering. Emergency power fed systems shall have red labels with white lettering.
3. Lettering sizes may vary due to space constraints or to distinguish between main versus branch systems. Sizes should be consistent throughout the project, use the following guidelines:

Switchboard or Panelboard Main Label:	1" high minimum
Switchboard or Panelboard Branches	1/2" high minimum
Starters, Disconnects, VFDs, Boiler e-stop station	1/2" high minimum
Manual Motor Starters	1/4" high minimum

4. All labels shall identify where panel or equipment is fed from. Ex (panel A fed from MDP)

B. Adhesive Tape Labels

1. Receptacles shall have the circuit number identified on the device cover plate using clear adhesive tape labels with 1/4" high printed block characters in black.
2. Provide circuit identification on junction or pull box covers for all circuits within.
3. Conductors in branch circuit panelboards shall have phase conductors, neutrals and grounds identified with adhesive labels within the panel at junction or pull boxes and at the device outlet box. Refer also to conductor color coding with respect to operating voltage.

2.5 CONDUCTOR COLOR CODING AND IDENTIFICATION

- A. Feeder phase conductors shall be identified as to phase and operating voltage using colored tape as follows:

	<u>480 Volt</u>	<u>120/208 Volt</u>
Phase A	yellow	black

Phase B	brown	red
Phase C	orange	blue
Neutral	gray	white
Ground	green	green

- B. Conductors from #18 up through #10 shall have colored insulating jackets to match the color code and phasing scheme as described above for feeders. Receptacle and lighting circuit conductors shall be #12 minimum for 15 or 20 amp circuits. Conductors #18 through #14 shall only be used for control circuits with colored jackets and wire numbers correlated to each system accordingly.
- C. Spare conductors shall be clearly identified as such through color, labels, tags, etc.

2.6 PANELBOARD DIRECTORY

- A. Provide typed directory. Handwritten is not acceptable.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to inside surface of door on panelboard.
- C. Contractor shall review the drawings to confirm all label schemes or ID requirements listed or noted on the drawings. Review mechanical drawings for equipment ID designation to provide a ID tag that corresponds to the mechanical equipment.
- D. Provide arc flash generic warning label on all electrical distribution equipment in accordance with NEC 2023 requirements. Provide PPE arc flash warning labels as specified with arc flash/short circuit coordination study.
- E. Panelboard, switchboards, transformers, etc. shall include their source of power included in nameplate label. (i.e. LPA feed from PP2)

END OF SECTION

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SECTION 26 05 83
WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Mechanical equipment.
- B. Food service.
- C. GPS clocks.
- D. Powerized modular furniture.
- E. Occupancy sensor equipment.
- F. Owner furnish equipment.
- G. Blank feed thru GFI

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 COORDINATION

- A. Coordinate work under provisions of Division 1.
- B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.

- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- E. Sequence electrical connections to coordinate with start-up schedule for equipment.
- F. Provide a 120 volt power supply in a junction box for use by the sprinkler contractor to connect to main sprinkler riser flow switch.
- G. Mechanical Trades shall be responsible to furnish and install all temperature control components, associated conduit, wiring and 120 volt power supplies. Electrical Trades shall reserve 120 volt circuit breaker as scheduled in the panels for this purpose.
- H. All food service control wiring shall be completed by the installing equipment contractor.
- I. All food service equipment is considered to include a factory installed cord/plug assembly. Electrical Contractor shall furnish cord/plug assemblies as required for all equipment not factory included, but requires a cord/plug connection. Complete all hard wired connections for all other food service equipment.
- J. All VFD programming shall be completed as part of the Mechanical Trades work.
- K. Where equipment will cover a GFI outlet within 6 feet of sink, provide a blank feed thru GFI test station.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

- A. Manufacturers:
 - 1. Hubbell, Pass & Seymour, Leviton or equal.
- B. Attachment Plug Construction: Conform to NEMA WD 1.
- C. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

- D. Cord Construction: ANSI/NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over current protection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using metallic flexible conduit for all dry interior locations. Use liquid tight non-metallic flexible conduit with watertight connectors in damp or wet locations and kitchen areas.
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- D. Provide the NEMA configuration that matches receptacle.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, power relays, motor starters and as noted on the drawings.
- G. Provide and install fuses in mechanical trades furnished fused disconnects and combination starters per manufacturer's requirements.
- H. Final power connection to powered furniture shall be completed by the installing vendor. Where the furniture system utilizes shared neutrals, the Electrical Trades shall furnish and install a circuit breaker tie.
- I. Electrical Contractor shall install mechanical furnished motor speed control and as required to control motor speed.
- J. Complete all lighting controls as scheduled, noted and shown on the drawings.
- K. Electrical Contractor shall complete all main power wiring to the mechanical equipment shown and noted.

- L. VFD control wiring and programming shall be completed as part of the Mechanical Trades bid. VFD shall be factory installed with the equipment unless noted or specified otherwise.

3.3 BLANK FEED THRU GFI

- A. Install a remote blank feed thru GFI where a refrigerator, freezer or other equipment that blocks access to the receptacle located within 6 feet of a sink.

END OF SECTION

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SECTION 26 09 13.26

CLOUD BASED ELECTRICAL POWER MANAGEMENT SYSTEM - SCHNEIDER ELECTRIC
ECOSTRUXURE ENERGY HUB

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cloud based electrical power management system (EPMS) and associated hardware, software, and services.

1.02 ABBREVIATIONS AND ACRONYMS

- A. IoT: Internet of Things.

1.03 DEFINITIONS

- A. Electrical power management system may also be identified as EPMS, EMS, PEMS, energy management system, electrical power monitoring system, power and energy monitoring system, or energy and power management system.
- B. Cloud Based: Subscription-based hosted application utilizing Software as a Service (SaaS) delivery model instead of on-premises software.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code); 2022.
- C. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ISO 9001 - Quality Management Systems — Requirements; 2015.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work to provide EPMS-compatible equipment and systems with sensors, interfaces, and other appurtenances required for specified functionality.

2. Coordinate work to provide AC or DC power supply required for IoT edge servers.

1.06 SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00.
- B. Shop Drawings: Provide manufacturer's standard catalog pages and data sheets, including physical data, electrical performance, electrical characteristics, and connection requirements.

1.07 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.08 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.09 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70.
 2. Requirements of local authorities having jurisdiction.
 3. Applicable local codes.
- B. Manufacturer Qualifications:
 1. Firm engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
 2. Certified in accordance with ISO 9001 with applicable quality assurance system regularly reviewed and audited by third-party registrar. Develop and control manufacturing, inspection, and testing procedures under guidelines of quality assurance system.
 3. Service, repair, and technical support services available 24 hours per day, 7 days per week from manufacturer or their representative.
- C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Prior to delivery to project site, verify suitable storage space is available to store materials in well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres.
- C. Protect materials during delivery and storage and maintain within manufacturer's written storage requirements. At minimum, store indoors in clean, dry space with uniform temperature to prevent condensation and protect electronics from potential damage from electrical and magnetic energy.
- D. Deliver materials to project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified in Contract Documents.
- E. Inspect products and report concealed damage or violation of delivery, storage, and handling requirements to engineer.

1.11 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.12 MANUFACTURERS

Schneider Electric; EcoStruxure Energy Hub; www.se.com/#sle.

B. Honeywell

C. Or EQUAL

1.13 CLOUD BASED ELECTRICAL POWER MANAGEMENT SYSTEM (EPMS) - GENERAL REQUIREMENTS

- A. Basis of Design: Schneider Electric; EcoStruxure Energy Hub; www.se.com/#sle.
- B. Provide data and analytics functionality for energy awareness, sustainability metrics, and power reliability/availability. Provide features, including but not limited to, real-time monitoring, alarm notification/management, energy, power, and sustainability data analytics/visualization to facilitate the following functions:
 - 1. Analyze energy usage and uncover savings opportunities.
 - 2. Meet and exceed energy efficiency and sustainability standards and certifications.
 - 3. Provide accurate documentation for regulatory compliance.
 - 4. Receive alarm notifications and view equipment status.
 - 5. Allocate energy costs across tenants and provide tenant bills.
- C. Data and analytics for EPMS operations, including but not limited to, centralized or remote display, analysis, logging, alarming, and event recording to be accessible

from supported web browser on desktop/laptop computer or tablet. Provide alarming and display capabilities via smart mobile device application.

D. Access to Software Services:

1. Grant Owner right to use cloud based EPMS software in accordance with terms and conditions of software and related subscription.
2. Subscription fees to be paid by owner.

E. Computer Hardware: Provided by Owner, for access to cloud based EPMS software via standard web browser.

F. Connected Equipment and Devices:

1. Provide EPMS network-connected devices as required to support specified cloud based EPMS functionality.
2. For equipment containing connected devices, provide local IoT edge server and internal wired communications network.
3. Provide wired Ethernet connection for internet access to each IoT edge server to facilitate communication with cloud based EPMS.
4. Internet access to be provided by Owner, including related internet service provider (ISP) fees.
5. Meters:
 - a. Applications:
 - 1) Low-Voltage Sub-Metering for Multiple
 - b. Multi-Circuit Meters: See Section 262713.13.

G. Communications and Interfaces:

1. Unless otherwise indicated, cloud based EPMS to communicate with connected equipment through compatible IoT edge server.
2. Support connection of unlimited number of compatible IoT edge servers, located at one or multiple geographically-distributed sites, to customer account for supporting system architecture.
3. IoT Edge Servers:
 - a. Communicate to devices using Ethernet or other supported protocol.
 - b. Support logging of data from connected devices for minimum of 14 days to avoid data loss due to interruption of cloud connection.
 - c. Support connection to minimum of 150 energy meters or 50 branch-circuit meters.
 - d. Cybersecurity: Certified as complying with IEC 62443 standards series.
4. Equipment Interface: For equipment connected to cloud based EPMS, provide interface compatible with cloud based EPMS IoT edge servers, including gateways, transceivers, and converters, integral to equipment.

1.14

ELECTRICAL DISTRIBUTION MONITORING AND ALARMING

- A. Provide screens displaying real-time data from electrical infrastructure.

- B. Display relevant real-time data from energy meters.
- C. Organize and display real-time data of cloud based EPMS software to provide logical views for system health and support cloud based EPMS applications.
- D. Provide set of screens for electrical single-line diagram of facility, including:
 - 1. Electrical parameters for equipment components on single-line diagram.
 - 2. Link to power equipment details screens.
- E. Equipment Details:
 - 1. Provide screens to display details pertaining to each piece of equipment, including equipment picture (if available), local single-line diagram (if applicable), information for each electrical section (e.g., breaker and disconnect switch), and alarm points.
 - 2. Measured peak demand and loading of equipment (e.g., breakers, UPSs, transformers, and generators).
 - 3. Navigation link to display details of each applicable meter/protection device.
- F. Provide summary status screen for alarm indication for major power equipment components of electrical distribution system.
- G. Alarms:
 - 1. Organize abnormal electrical conditions, events, and group-related incidents in descending timestamp order for situational awareness and actionable intelligence.
 - 2. Notify appropriate staff members of alarms through smart mobile device application.

1.15 ENERGY USAGE AND BENCHMARKING

- A. Provide energy analysis and benchmarking features to isolate factors contributing to energy usage, analyze energy usage patterns, and implement energy conservation measures.
- B. Capabilities:
 - 1. Categorize energy usage by load types (e.g., HVAC, lighting, and plug loads) to identify where to focus energy conservation initiatives.
 - 2. Aggregate energy usage by site, building, floor, area, or zones.
 - 3. Monitor unmetered areas and circuits using virtual (calculated) meters.
 - 4. Compare and rank top contributors to energy usage across multiple sites, buildings, floors, areas, zones, equipment, or devices.
 - 5. Monitor and report on energy usage in accordance with ASHRAE Std 90.1 I-P, ICC (IECC), USGBC LEED, and CAL TITLE 24 P6.
 - 6. Generate energy analysis reports on demand.
 - 7. Generate software-based energy alerts based on user-defined thresholds.
 - 8. Display relevant energy analysis parameters on dashboard screens.

9. Normalize energy data based on common energy drivers such as energy intensity.
- C. Provide reports to support benchmarking initiatives for improved energy efficiency, including:
 1. Energy Ranking Report: Display and compare top five largest consumers of energy, by site, by building, and by load type.
 2. Energy Usage Report: Display monthly, daily, or hourly energy usage by site, building, floor, area, or equipment.

1.16 TENANT ENERGY BILLING

- A. Provide energy cost allocation and tenant billing features to generate bills for facility tenants.
- B. Tenant Configuration Capabilities:
 1. Support allocation of one or multiple energy meters, or multiple building areas to tenant.
 2. Support allocation of energy usage in unmetered areas based on virtual (calculated) meters.
 3. Support setup of energy rate tariffs.
- C. Rate Tariff Capabilities:
 1. Rate based on flat or blended rate (\$/kWh).
 2. Peak demand charge (\$/kW) in generated energy bill.
 3. Taxes and other administration fees.
- D. Tenant Billing Capabilities:
 1. Generate tenant bills per user-defined date range.
 2. Generate tenant bills for period based on new billing parameters or saved parameters saved from previous period.
 3. Generate tenant bills simultaneously for selected tenants in bill run.
 4. Verify bill calculations on per-tenant basis prior to export.
 5. Generate tenant bills in PDF format.

1.17 CLOUD BASED EPMS SOFTWARE

- A. Basis of Design: Schneider Electric; Square D EcoStruxure Energy Hub; www.se.com/#sle.
- B. Provide access to cloud-hosted software platform designed as operational interface for EPMS to manage safe, reliable, and efficient power within buildings/facilities.
- C. Provide specialized data acquisition, visualization, analysis, and reporting tools designed for power management applications.

- D. Support multiple types of devices designed for energy management and electrical system monitoring, including power meters, branch/multi-circuit meters, energy meters, and smart panels with communicating circuit breakers.
- E. Provide native device support, without requiring additional installation or configuration, including:
 - 1. Registers premapped to standard measurement names.
 - 2. Set of factory device graphical screens.
 - 3. Factory-tested support.
- F. Configuration and Setup:
 - 1. Support setup through self-service onboarding without intervention.
 - 2. Support basic configuration, including adding devices and user accounts, performed remotely and without active subscription or license.
 - 3. Support addition of devices and cloud-connected gateways by scanning compatible QR code through cloud based EPMS smart mobile device application.
 - 4. Automatically discover devices connected to cloud-connected gateways.
 - 5. Automatically import device context, including name and topology information, to avoid duplicate data entry and configuration steps.
 - 6. Automatically discover other gateways and devices included in same order once first one has been added.
 - 7. Support configuration of connected-device energy usage using graphical drag-and-drop interface through web browser.
 - 8. Support configuration of virtual (calculated) devices for unmetered circuits in electrical panel with metered incomer and feeders.
 - 9. Support identification of sites by address with automatic address validation based on user input and displayed on map.
 - 10. Automatically create default dashboards and navigation based on devices and contextualization added by user.
 - 11. Support role-based user access down to site level with invitation of new users by email address.
- G. Alarm Management and Notification:
 - 1. Support acquisition and display of specialized, on-board alarms from power distribution equipment.
 - 2. Support creation of software alarms based on configured thresholds.
 - 3. Provide displays of alarms filtered by location or asset, with navigation links to detailed information on individual alarm occurrences (e.g., start time and priority).
 - 4. Support acknowledgement of alarms by authorized users.
 - 5. Provide native smart mobile device iOS/Android application for receiving and acknowledging alarm notifications remotely with capability for user to configure notification preferences for specific alarms and view historical alarms.
- H. Data Analytics and Visualization:

1. Provide interactive, web-based dashboard application supporting system devices.
2. Support visualization of multiple sites in single view.
3. Support display of geographically distributed sites in map view.
4. Support display of different views for physical location of assets and location of energy usage.
5. Support display of electrical devices in graphical single-line diagram for each site.
6. Provide graphical system views that allow users to pan and zoom, with dynamic adjustment of detail level displayed depending on zoom level.
7. Support generation of reports.
8. Support downloaded of data in .csv format.

I. Technical Infrastructure:

1. Software platform to be completely hosted and supported by software developer.
2. Software developer to monitor and maintain operation of software platform, including ongoing cybersecurity/threat monitoring, disaster recovery/backup processes, and software patches/upgrades.
3. Automatically acquire onboard data (e.g., events, trends, and waveforms) from natively supported device types through supported IoT edge servers without requiring additional software configuration or data upload scheduling.
4. Support real-time and historical data aggregation within defined hierarchy views (e.g., buildings/floors/rooms), including:
 - a. Web-based, end-user interface.
 - b. Automatic, intelligent data aggregation across hierarchy nodes for data visualization.
5. Remain online during system administration functions, including communications, logging, and alarming; do not require operator to take system offline.

J. Interoperability and Integration:

1. Provide API allowing third-party systems (e.g., BMS) to consume data collected by EPMS platform.
2. Provide mechanism to export collected energy data to csv format.

K. Cybersecurity and Data Privacy: Comply with best practices and provide technical features to reduce risk to people, assets, and processes, including:

1. Develop software platform in accordance with Secure Development Lifecycle 2.0 procedures.
2. Substantially develop software platform in location certified as complying with IEC 62443 standard series.
3. Support role-based user access.
4. Comply with General Data Protection Regulation (GDPR).
5. Use HTTPS for communication between edge and cloud.
6. Encrypt data in transit and at rest.
7. Authenticate genuineness of cloud-connected devices.

L. Products:

1. Schneider Electric; Square D EcoStruxure Energy Hub; www.se.com/#sle.

2. Honeywell
3. Or EQUAL

1.18 EXAMINATION

- A. Examine equipment exterior and interior for damage, including but not limited to, structure, moisture, and mildew.
- B. Examine for conditions detrimental to completion of work.

1.19 INSTALLATION

- A. Install equipment in accordance with manufacturer's written instructions.

1.20 FIELD QUALITY CONTROL

- A. Perform functional testing, commissioning, and first parameter adjusting.

1.21 CLOSEOUT ACTIVITIES

- A. Functional Demonstration Testing: As part of commissioning, demonstrate proper operation of cloud based EPMS under normal operating conditions.
- B. Training: Cloud based EPMS supplier to provide orientation session on system usage and configuration, which may be recorded for operator training purposes.

1.22 PROTECTION

- A. Protect installed cloud based EPMS equipment from subsequent construction operations.

END OF SECTION

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SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Power packs.
- B. Occupancy sensor.
- C. Low voltage push button stations.
- D. CAT 5E wiring.
- E. Low-voltage momentary switching.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. ASHRAE 90.1 2019 Energy Code.
- B. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 State of Michigan Code Rules Part 8, 2009 ICC/ANSI 117.1 and local code requirements.
- C. 2021 Michigan Energy Code.

1.4 SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00.
- B. Shop Drawings: Occupancy sensor cut sheets, control panel layouts, wiring connections, diagrams, and dimensions. Cut sheets shall either be marked or arrowed components with catalog numbers. Failure to comply will be cause to return the submittals for corrections at no delays or extra costs to the Owner.

1.5 REGULATORY REQUIREMENTS

- A. ASHRAE 90.1 2019.

- B. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- C. Products: Furnish products listed or labeled to Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- D. 2021 Michigan Energy Code.
- E. 2015 Life Safety Code. NFPA 101. Chapter 7 – 7.8.1.2.2 Means of Egress Lighting.

PART 2 PRODUCTS

2.1 SYSTEM COMPLIANCE

- A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.
- B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.
- C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.
- D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.
- E. System listed as qualified under DesignLights Consortium Networked Lighting Control System Specification v5.0.
- F. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 POWER PACKS

- A. As scheduled on the drawings.

2.3 OCCUPANCY SENSORS

- A. As scheduled on the drawings.

2.4 LOW VOLTAGE PUSH BUTTON STATIONS

- A. As scheduled on the drawings.

2.5 CAT 5E WIRING

- A. As scheduled on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and wiring diagrams.
- B. Contractor shall provide all components, etc. above those specified or shown for a complete installation.

3.2 FUNCTIONAL TESTING

- A. Provide functional testing with 2019 ASHRAE.
- B. Provide certified documents that lighting controls were tested for programming and working conditions.

END OF SECTION

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SECTION 26 21 00

LOW VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Arrangement with Utility Company and Owner for permanent electric service.
- B. Underground service entrance.
- C. Metering equipment.
- D. Letter of authorization.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 SYSTEM DESCRIPTION

- A. System Characteristics: As scheduled on the drawings.
- B. Service Entrance: As scheduled on the drawings.

1.5 PRE-INSTALLATION CONFERENCE

- A. Arrange with the Owner or Construction Manager to hold a job site meeting with the utility to overview the new service installation sequence and project schedules.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 UTILITY METERS

- A. Meters will be furnished by Utility Company.

2.2 UTILITY METER BASE

- A. Meter base will be furnished by Utility Company.

2.3 TRANSFORMER PAD

- A. Description: As detailed on the drawing.

2.4 SERVICE UPGRADE COSTS

- A. The Owner shall pay all service costs assessed directly by the utility.

2.5 LETTER OF AUTHORIZATION

- A. Owner shall provide a written document that grants permission to the Engineer/ Architect to talk with the utility for electrical service.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that service equipment is ready to be connected and energized.

3.2 PREPARATION

- A. Make arrangements with Utility Company to obtain permanent electric service to the project.
- B. Coordinate location of Utility Company's facilities to ensure proper access is available. Owner shall be responsible to prepare and submit letter of authorization as required by the utility.

3.3 INSTALLATION

- A. Install service entrance conduits as shown or noted on the drawings.
- B. Contractor shall work extended hours or weekends as required to complete the service entrance installation.
- C. All backfilling, grading, seeding shall be completed as part of the site contractor's bid upon completion of the utility's work.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Distribution panelboards.
- B. Branch circuit panelboards.
- C. ARC Energy reduction NEC 2023 Article 240.87.
- D. Surge Protective Device (SPD) for emergency generator panelboards.
- E. Arc-fault circuit interrupter circuit breaker.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers.
- B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA KS 1 - Enclosed Switches.
- D. NEMA PB 1 - Panelboards.
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- F. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.4 SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00.

- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- D. Panelboard submittal shall match drawing schedule arrangement. Submittal shall custom edit schedules to match design drawings.
- E. Manufacturer and Contractor shall verify the overcurrent protective device to match wire size as shown and noted in the bid documents.

1.5 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. As scheduled on the drawings.

2.2 DISTRIBUTION PANELBOARDS

- A. Panelboards: NEMA PB 1, circuit breaker type or fusible switch type per plan.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- D. Molded Case Circuit Breakers with Current Limiters: NEMA AB 1. Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

- E. Current Limiting Molded Case Circuit Breakers: NEMA AB 1. Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole.
- F. Provide circuit breaker accessory trip units and auxiliary switches as indicated.
- G. Cabinet Front: Surface type, fastened with concealed trim clamps, hinge and latch. Provide hinged door with flush lock. Finish in manufacturer's standard gray enamel.

2.3 BRANCH CIRCUIT PANELBOARDS

- A. As scheduled on the drawings.

2.4 ARC ENERGY REDUCTION

- A. Furnish an energy reducing maintenance switch for a circuit breaker rated 1200 amps or higher.

2.5 SURGE PROTECTIVE DEVICE (SPD)

- A. Furnish a factory installed SPD suppression on all emergency generator panelboards as scheduled.

2.6 ARC-FAULT CIRCUIT INTERRUPTER

- A. Furnish listed combination type arc-fault circuit interrupter device for dwelling units and dorm rooms.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Height: 6 ft to top of panelboard; install panelboards taller than 6 ft with bottom no more than 4 inches above floor.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- E. Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- F. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.
- G. Arc-fault protection is required on all 120 volt branch circuits supplying 15 amp and 20 amp receptacles installed in dwelling units.

3.2 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed to assure proper operation.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

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SECTION 26 27 13.13

POWER AND ENERGY METERS - SCHNEIDER ELECTRIC POWERLOGIC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. ADVANCED MULTI-CIRCUIT METERS

RELATED SECTIONS

All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.02 ABBREVIATIONS AND ACRONYMS

A. EPMS: Electrical power management system.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.

C. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.

D. IEC 61000-6-5 - Electromagnetic Compatibility (EMC) – Part 6-5: Generic Standards – Immunity for Equipment Used in Power Station and Substation Environment; 2015 (Corrigendum 2017).

E. IEC 61010-2-030 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-030: Particular Requirements for Equipment Having Testing or Measuring Circuits; 2023.

F. IEC 61326-1 - Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements – Part 1: General Requirements; 2020.

G. IEC 61557-12 - Electrical Safety in Low Voltage Distribution Systems Up to 1 000 V AC and 1 500 V DC - Equipment for Testing, Measuring or Monitoring of Protective Measures - Part 12: Power Metering and Monitoring Devices (PMD); 2018 (Corrigendum 2022).

- H. IEC 62052-11 - Electricity Metering Equipment – General Requirements, Tests, and Test Conditions – Part 11: Metering Equipment; 2020.
- I. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.
- J. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S); 2020.
- K. IEC 62443-4-1 - Security for Industrial Automation and Control Systems – Part 4-1: Secure Product Development Lifecycle Requirements; 2018.
- L. IEC 62443-4-2 - Security for Industrial Automation and Control Systems – Part 4-2: Technical Security Requirements for IACS Components; 2019.
- M. IEC 62974-1 - Monitoring and Measuring Systems Used for Data Collection, Gathering and Analysis – Part 1: Device Requirements; 2017.
- N. IEEE 802.3 - IEEE Standard for Ethernet; 2022, with Amendment (2024).
- O. IEEE 802.11 - IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications; 2020, with Amendment (2023).
- P. IEEE 802.15.4 - IEEE Standard for Low-Rate Wireless Networks; 2020, with Corrigendum (2022).
- Q. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).
- R. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.
- S. ISO 50001 - Energy Management Systems – Requirements with Guidance for Use; 2018.
- T. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- U. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- V. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- W. UL 2808 - Energy Monitoring Equipment; Current Edition, Including All Revisions.
- X. UL 61010-1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements; Current Edition, Including All Revisions.

- Y. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

1.04

SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00.
- B. Provide sufficient information to determine compliance with Contract Documents. Identify submittal data with specific equipment tags and/or service descriptions to which they pertain. Identify specific model numbers, options, and features of equipment proposed.
- C. Indicate deviations from Contract Documents with reference to corresponding drawing or specification number and written justification for deviation.
- D. Shop Drawings: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.
- E. Shop Drawings: Include system interconnection schematic diagrams showing factory and field connections.
- F. Manufacturer's qualification statement.
- G. Operation and Maintenance Data:
 - 1. Provide detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - a. Include manufacturer, supplier, support, and repair center contact information.
 - b. Include manufacturer's standard operation and maintenance data assembled for each size and type of equipment furnished.
 - c. Include contact information for parts stocking location closest to Owner.
 - d. Identify critical spare parts associated with long lead times and/or those critical to unit operation.
 - e. Identify maintenance spare parts required to regularly perform scheduled equipment maintenance including, but not limited to, consumable parts required to be exchanged during scheduled maintenance periods.
- H. Specimen Warranty: Statement of standard warranty and extended warranty options/costs.
- I. Executed warranty.
 - 1. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

2. Tools: Manufacturer-specific special tools required to install, remove, test, and maintain metering components.

1.05 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.
- C. Manufacturer Qualifications:
 1. Firm engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
 2. Certified in accordance with ISO 9001 with applicable quality assurance system regularly reviewed and audited by third-party registrar. Develop and control manufacturing, inspection, and testing procedures under guidelines of quality assurance system.
 3. Service, repair, and technical support services available 24 hours per day, 7 days per week from manufacturer or their representative.
 4. Certified in accordance with ISO 14001, with product environmental profiles (PEPs) for specified products.
- D. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Prior to delivery to project site, verify suitable storage space is available to store materials in well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres.
- B. Protect materials during delivery and storage and maintain within manufacturer's written storage requirements. At minimum, store indoors in clean, dry space with uniform temperature to prevent condensation and protect electronics from potential damage from electrical and magnetic energy.
- C. Deliver materials to project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified in Contract Documents.
- D. Inspect products and report concealed damage or violation of delivery, storage, and handling requirements to engineer.

1.07 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for 18 months from date of invoice. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Schneider Electric; PowerLogic; www.se.com/#sle.

- B. Honeywell
- C. Or EQUAL

2.02 GENERAL REQUIREMENTS

- A. List as complying with UL 61010-1.
- B. Certified for use in energy management systems in accordance with ISO 50001.
- C. Electromagnetic Compatibility:
 - 1. Comply with IEC 61000-6-5 and IEC 61326-1.
 - 2. Comply with FCC requirements of 47 CFR 15, Class B.

2.03 ADVANCED MULTI-CIRCUIT METERS

- A. Capable of monitoring multiple circuits for network management, energy cost management, energy allocation, and operational efficiency.
- B. Form Factor: DIN rail mounting.
- C. Voltage and Current Inputs:
 - 1. Support direct connection of low-voltage circuits up to 480 VAC without requiring voltage (potential) transformers.
 - 2. Provide terminal block for voltage inputs and removable connectors for control power and communications.
 - 3. Provide 250 mV current transformer inputs to support CTs up to 6,000 A.
- D. Control Power: Support low-voltage input of 24 VDC or up to 480 VAC/250 VDC through external power supply.
- E. Measured and Calculated Metering Parameters:

1. Support full range of 3-phase voltage, current, power, and energy measurements, power factor, frequency, total harmonic distortion (THD), and individual power harmonics readings (up to 63rd order).
 2. Branch Circuit and Busway Monitoring: Support up to 192 monitored circuits with current, power, and energy measurements, power factor, frequency, total harmonic distortion (THD), and individual power harmonics (up to 63rd order).
- F. Measurement Accuracy:
1. ANSI C12.20; Class 0.5.
 2. Sample current/voltage simultaneously without gaps with minimum of 128 samples per cycle (zero blind).
- G. Display: 4.3-inch (109 mm), 480x272 resolution or 7-inch (178 mm), 800x480 resolution TFT backlit touch screen; capable of displaying main or branch circuit values.
- H. Inputs/Outputs: Support two digital inputs and one digital output.
- I. Communications:
1. Support serial RS485 Modbus, Ethernet Modbus TCP, and IPv6.
 2. Provide two Ethernet ports for daisy-chain wiring from meter to meter, used as switch or separated ports (one IP address for each); independently controllable to enable/disable or specify protocols.
 3. Support network automatic discovery on Ethernet network without requiring user configuration or interaction.
 4. Support serving data over Ethernet network accessible through web browser with default pages from factory.
 5. Provide native BACnet/IP support, capable of communicating via Modbus TCP/IP and BACnet/IP simultaneously.
 6. Provide native SNMP support, capable of communicating via Modbus TCP/IP and SNMP simultaneously.
 7. Support upgradeable firmware to enhance functionality through Ethernet connection.
- J. Onboard Logging:
1. Support logging nonvolatile event and 20 user-configurable data logs.
 2. Provide 8 GB of storage for logged data and waveform captures.
- K. Alarming: Provide user-defined alarms for low/high voltage, high current, and tripped breaker detected.
- L. Disturbance Detection: Provide voltage sag and swell detection with waveform capture for both current and voltage channels at 133 samples per cycle.
- M. Products:
1. Schneider Electric; PowerLogic HDPM6000 series.
 2. Honeywell
 3. Or Equal

2.04 ELECTRICAL POWER MANAGEMENT SYSTEM CAPABILITIES

- A. See Section 26 09 13.26 EcoStruxure Energy Hub cloud based software for additional requirements.
- B. Provide communications connectivity and functionality to support electrical power management system (EPMS), including but not limited to:
 - 1. Communications connectivity via Ethernet network and protocols of EPMS and related equipment, either through communications gateway or integral interface.
 - 2. Compliance with recognized cybersecurity requirements.
 - 3. Remote EPMS capability for equipment configuration, operational control, electrical power monitoring, power quality monitoring, compliance, and correction; alarm monitoring with event log.
 - 4. Breaker aging modeling for electronic trip circuit breakers.
 - 5. Continuous thermal monitoring capabilities, including alarming, notification, and visualization.
- C. Provide factory-tested native software compatibility, including the following:
 - 1. Capability for pre-engineered, interactive graphical display screens to view and analyze real-time device data.
 - 2. Pre-mapping of registers to standard measurement names without need for additional configuration or internal device registers.
 - 3. Automatic collection and logging of device data by EPMS software without additional configuration.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Examine equipment exterior and interior for damage, including but not limited to, structure, moisture, and mildew.
- B. Examine for conditions detrimental to completion of work.

2.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's written instructions.

2.03 FIELD QUALITY CONTROL

- A. Manufacturer Services: Provide services of manufacturer's field representative to perform functional testing, commissioning, and first parameter adjusting.
 - 1. Test and adjust controls and safeties.
 - 2. Replace damaged or malfunctioning equipment and report discrepancies or installation issues.

2.04 PROTECTION

- A. Protect installed meters from subsequent construction operations.

2.05 CLOSE-OUT

- A. Provide O&M manuals, warranty letter, as-built drawings and inspection sign-off.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Device plates.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. NEMA WD 1 - General Requirements for Wiring Devices.
- B. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
- C. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- D. ADA - Americans with Disabilities Act - As amended.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Pass & Seymour, Hubbell, Leviton or equal.

- B. Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch.
- C. Body and Handle: Color to be determined from standard colors by the Architect.
- D. Ratings:
 - 1. Voltage: 120/277 volts, AC.
 - 2. Current: 20 amperes.

2.1 WALL DIMMERS

- A. Manufacturers:
 - 1. As scheduled on the drawings.

2.2 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell, Pass & Seymour, Leviton, or equal
- B. Description: NEMA WD 1, Heavy-duty specification grade duplex receptacle.
- C. Device Body: Color to be determined from standard colors by the Architect.
- D. Configuration: NEMA WD 6, type as specified and indicated.
- E. Convenience Receptacle: Type 5-20.
- F. Emergency receptacles shall be red with matching cover plate and shall be provided with LED power indicating light.
- G. GFCI Receptacle: Convenience duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- H. Damp and wet location receptacles shall be rated "WR".

2.3 WALL PLATES

- A. Cover Plate: Color to be determined from standard colors by the Architect.
- B. Use stainless steel cover for food service areas, and healthcare facilities.
- C. Use "in use" weather proof metallic covers at exterior locations as indicated on the drawings to meet 2023 NEC Section 406.
- D. Provide blank metal cover plates on abandoned boxes.
- E. Provide stamped metal cover plate for unfinished spaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.

- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install receptacles with grounding pole on bottom.
- D. Connect wiring device grounding terminal to outlet box with bonding jumper or branch circuit equipment grounding conductor where specified.
- E. Install plates on switch, receptacle, and blank outlets in finished areas.
- F. Connect wiring devices by wrapping conductor around screw terminal.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- H. Install protective rings on active flush cover service fittings.
- I. Shared neutral are not permitted for lighting and power circuits.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Confirm with architectural drawings for counter casework, etc. details for wiring devices mounting heights.
- B. Install wall switch 48 inches to top of box above finished floor.
- C. Install convenience receptacle 16 inches to bottom of box above finished floor.
- D. Install convenience receptacle 6 inches above backsplash of counter.
- E. Install dimmer 48 inches to top of box above finished floor.
- F. 18" mounting height is lieu of the 16" minimum specified is acceptable pending masonry course lines.
- G. Electrical Trades shall review 2017 ICC/ANSI A117.1 for ADA requirements. Obtain a copy as required.

- H. Refer to all other sections of the specification, drawings, and Architectural drawing for specific mounting requirements for clocks, receptacles shown in counters, work stations. Do not rely solely on the electrical drawings for this information. Division 26 & 28 Contractor shall be responsible to review all project documentation and obtain all required information from the district.
- I. Refer to section 28 46 13 and drawing notes for fire alarm device mounting heights.

3.5 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

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SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fusible switches.
- B. Nonfusible switches.
- C. Fuses.

1.2 REFERENCES

- A. NEMA KS 1 - Enclosed Switches.
- B. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- C. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
- D. UL 198E - Class R Fuses.

1.3 SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00.
- B. Product Data: Provide switch ratings and enclosure dimensions.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. As scheduled on the drawings.

2.2 ENCLOSED SWITCHES

- A. Fusible Switch Assemblies: NEMA KS 1, Type Heavy Duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate Class R fuses.
- B. Nonfusible Switch Assemblies: NEMA KS 1, Type Heavy Duty load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.
- C. Enclosures: NEMA KS 1.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
- D. Disconnect switches serving the elevator main power must be a heavy duty type to meet the State of Michigan Elevator Code. Disconnect switch shall include auxiliary contacts for use by the elevator contractor to send a signal the main power disconnect is open.

2.3 FUSES

- A. Manufacturers:
 - 1. Bussman or equal.
- B. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt.
- C. Interrupting Rating: 200,000 rms amperes.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches where indicated.
- B. Install fuses in fusible disconnect switches.
- C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.
- D. Electrical Contractor shall be responsible to review the mechanical equipment schedules to determine if any factory installed switches are scheduled and noted as part of the equipment to minimize duplication by electrical trades.

END OF SECTION

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SECTION 26 32 00

PACKAGED ENGINE GENERATOR/TRANSFER SWITCH

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Packaged engine generator set.
- B. Battery and charger.
- C. Remote annunciator.
- D. Transfer switch.
- E. Gen set enclosure.
- F. Building automation system interface.
- G. Remote emergency stop station.
- H. Start wire monitor unit.
- I. Generator ground fault alarm.
- J. 3 Pole transfer switch.
- K. ARC reduction switch for transfer switch.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself, but is supplementary to the entire specification and drawings.

1.3 SCOPE

- A. Provide complete factory assembled generator set equipment with transfer switches and controls in accordance with plans and specifications.
- B. Provide factory test, startup by a supplier authorized by the manufacturer, and on-site testing of the system.
- C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service.

- D. Provide on-site commissioning.
- E. The generator manufacturer shall list all differences that do not meet the specification.
- F. Provide on-site acceptance test in accordance with NFPA 110 requirements.

1.4 CODES AND STANDARDS

- A. The generator set and its installation and on-site testing shall conform to the requirements of the following codes and standards:
 - 1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
 - 2. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
 - 3. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
 - 4. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 5. FCC Part 15, Subpart B.
 - 6. IEC8528 part 4. Control Systems for Generator Sets
 - 7. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 - 8. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 - 9. IEEE587 for voltage surge resistance.
 - 10. NEMA ICS10-1993 – AC Generator sets.
 - 11. NFPA70 – National Electrical Code 2023.
 - 12. UL508. The entire control system of the generator set shall be UL508 listed and labeled.
 - 13. 2019 edition NFPA 110 Emergency and Standby Power Systems. Level 1, Type 10 classification for Life Safety.
 - 14. 2018 NFPA 37 Standards for Combustion Engines.
 - 15. Generator to be UL 2200 listed.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Furnish products listed or labeled to conform to requirements of 2023 National Electric Code, 2023 Michigan Electric Code Rules Part 8, and local codes.

1.6 SUBMITTALS

- A. Provide submittals as listed in Section 26 01 00.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and

interconnection diagrams.

- C. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, and automatic transfer switch. Failure to provide cut sheets either arrowed or marked with catalog numbers will be cause for returning the submittals at no delays or extra costs to the district.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 OPERATION AND MAINTENANCE DATA

- A. Operation Data: Include instructions for normal operation.
- B. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site.
- B. Accept unit on site on skids. Inspect for damage.
- C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cummins, or as scheduled on the drawings.

2.2 GENERATOR SET

- A. Ratings
 - 1. The generator set shall operate at 1800 rpm and at a voltage of: 120/208 Volts AC, Three phase, four-wire, 60 hertz.
 - 2. The generator set shall be rated at 70 kW, minimum 88 kVA at 0.8 power factor. Minimum 306skVA and maximum 30% voltage dip.
 - 3. The generator set rating shall be based on emergency/standby service as scheduled on the drawings.
 - 4. Generator shall include a factory installed 200 amp circuit breaker for emergency power loads.

5. Circuit breakers shall be upsized in accordance with manufacturer's requirements when quoting above the minimum 70kw.
6. 80 degree C riser over 40 degree C ambient.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The natural gas fueled engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

2.3 ENGINE AND ENGINE EQUIPMENT

- A. The engine shall be natural gas, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:
- B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control

the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

- C. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H₂O external static head. Radiator shall be sized based on a core temperature which is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
- D. Electric starter(s) capable of three complete cranking cycles without overheating.
- E. Positive displacement, mechanical, full pressure, lubrication oil pump.
- F. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
- G. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
- H. Replaceable dry element air cleaner with restriction indicator.
- I. Flexible supply and return fuel lines.
- J. Engine mounted battery charging alternator, ampere rated for generator size with solid-state voltage regulator.
- K. Coolant heater
 - 1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
 - 2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
 - 3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.
- L. Provide critical silencer exhaust and weather proof enclosure. Provide exhaust silencers for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.
- M. Provide a block heater sized by the manufacturer to meet low-temperature operating conditions.

2.4 AC GENERATOR

- A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 80 degrees Centigrade.
- B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.
- C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.
- D. The sub transient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.5 GENERATOR SET CONTROLLER

- A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.
- B. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
- C. The generator set mounted control shall include the following features and functions:

D. Control Switches

1. Mode Select Switch: The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. Emergency Stop Switch: Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. Reset Switch: The reset switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. Panel Lamp Switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

E. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
2. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
3. Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

F. Generator Set Alarm and Status Display.

1. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on an alphanumeric digital display panel:
 - low oil pressure (alarm)
 - low oil pressure (shutdown)
 - oil pressure sender failure (alarm)
 - low coolant temperature (alarm)
 - high coolant temperature (alarm)
 - high coolant temperature (shutdown)
 - engine temperature sender failure (alarm)
 - low coolant level (alarm or shutdown--selectable)
 - fail to crank (shutdown)
 - fail to start/overcrank (shutdown)

overspeed (shutdown)
low DC voltage (alarm)
high DC voltage (alarm)
weak battery (alarm)
low fuel-daytank (alarm)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (alarm) (optional--when required by code or specified)
over load (alarm)
emergency stop (shutdown)

2. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
3. Provide a remote wall mounted annunciator.

G. Engine Status Monitoring.

1. The following information shall be available from a digital status panel on the generator set control:
 - engine oil pressure (psi or kPA)
 - engine coolant temperature (degrees F or C)
 - engine oil temperature (degrees F or C)
 - engine speed (rpm)
 - number of hours of operation (hours)
 - number of start attempts
 - battery voltage (DC volts)
2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

H. Engine Control Functions.

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.
2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

2.6 OUTDOOR WEATHER-PROTECTIVE HOUSING

- A. The generator set shall be provided with a Level 2 housing which allows the generator set to operate at full rated load in the ambient conditions previously specified.
- B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors. Door hinges shall be stainless steel.
- C. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield. Sound level shall match Level enclosure.
- D. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color. All surfaces of all metal parts shall be primed and painted.
- E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

2.7 BATTERIES

- A. Batteries - battery shall be rate suitable for generator starting mode. Battery voltage shall be compatible with the starting system. The battery set shall be rated no less than 172 ampere hours. Provide all cables and clamps.
- B. Battery Trays - Battery tray shall be provided for the batteries. Tray shall be treated to be battery electrolyte resistant. Tray construction shall be such to contain any spillage or boil over.
- C. Battery Charger - Battery charger, current limiting type to automatically recharge batteries. Charger shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC volt meter and fused AC input. AC input voltage shall be 120 volts. Charger shall have LED annunciation for low DC volts, rectifier failure, loss of AC power, high DC volts. Amperage output shall be no less than ten amperes. Charger shall be factory installed as part of generator equipment. No wall mounted charger is permitted for this project.

2.8 TRANSFER SWITCH

- A. Provide transfer switches as scheduled on the drawings.
- B. General Transfer-Switch Product Requirements
 - 1. Provide transfer switches in the number and ratings as specified. Apply as defined in UL 1008 for continuous loading and total system transfer.
 - 2. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
 - 3. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).
 - 4. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
 - 5. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).
 - 6. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - a. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
 - b. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
 - c. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
 - d. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
 - e. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
 - f. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
 - g. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
 - h. The transfer switch shall be program transition with the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
 - 1) Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
 - 7. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and

destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

8. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

C. Automatic Transfer Switches

1. Automatic Transfer Switch Control Features

- a. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
- b. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
- c. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
- d. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
- e. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
- f. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
- g. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
- h. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

2. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

- a. The indicator panel LEDs shall display:
 - 1) Which source the load is connected to (Source 1 or Source 2)
 - 2) Which source or sources are available
 - 3) When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
 - 4) When the switch is in test/exercise mode
 - b. The indicator shall have pushbuttons that allow the operator to activate the following functions:
 - 1) Activate pre-programmed test sequence
 - 2) Override programmed delays, and immediately go to the next operation
 - 3) Reset the control by clearing any faults
 - 4) Test all of the LEDs by lighting them simultaneously
 - c. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:
 - 1) AC voltage for all phases, normal and emergency
 - 2) Source status: connected or not connected.
 - 3) Load data, including voltage, AC current, frequency, KW, KVA, and power factor.
 - d. The display panel shall be password-protected, and allow the operator to view and make adjustments:
 - 1) Set nominal voltage and frequency for the transfer switch
 - 2) Adjust voltage and frequency sensor operation set points
 - 3) Set up time clock functions
 - 4) Set up load sequence functions
 - 5) Enable or disable control functions including program transition
 - 6) View real-time clock data, operation log (hours connected, times transferred, failures) and service history
3. Control Functions: Functions managed by the control shall include:
- a. Software adjustable time delays:
 - 1) Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
 - 2) Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
 - 3) Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
 - 4) Engine cooldown: 0 to 30 minutes (default 10 min)
 - 5) Programmed transition: 0 to 60 seconds (default 3 sec)
 - b. Undervoltage sensing: three-phase normal, three-phase emergency source.
 - 1) Pickup: 85 to 98% of nominal voltage (default 90%)
 - 2) Dropout: 75 to 98% of nominal voltage (default 90%)
 - 3) Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
 - 4) Accurate to within +/- 1% of nominal voltage
 - c. Over-voltage sensing: three-phase normal, three-phase emergency source.
 - 1) Pickup: 95 to 99% of dropout setting (default 95%)
 - 2) Dropout: 105 to 135% of nominal voltage (default 110%)
 - 3) Dropout time delay: 0.5 to 120 seconds (default 3 sec)
 - 4) Accurate to within +/- 1% of nominal voltage

- d. Over/under frequency sensing:
 - 1) Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
 - 2) Dropout: +/-1% beyond pickup (default 1%)
 - 3) Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
 - 4) Accurate to within +/- 0.2%
- e. Voltage imbalance sensing:
 - 1) Dropout: 2 to 10% (default 4%)
 - 2) Pickup: 90% of dropout
 - 3) Time delay: 2.0 to 20 seconds (default 5 sec)
- f. Phase rotation sensing:
 - 1) Time delay: 100 msec
- g. Loss of single-phase detection:
 - 1) Time delay: 100 msec
- 4. Control features shall include:
 - a. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.
 - 1) Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.
 - b. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
 - c. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
 - d. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.
- 5. Control Interface
 - a. Provide two sets Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
 - b. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
 - c. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.
- 6. Engine Starting Contacts
 - a. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.9 SEQUENCE OF OPERATION

- A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

- B. The generator set shall complete a time delay start period as programmed into the control.
- C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
 - 1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate "fail to crank" shutdown.
 - 2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate "fail to start".
 - 3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
- D. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand, or load govern state.
- E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.
- F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.
 - 1. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

2.10 FACTORY TESTING.

- A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.
- B. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

2.11 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested for compliance with the specification and NFPA 110 7.13.2.1. Testing shall be conducted by representatives of the

manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

- B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110 7.13.4.1. Provide a resistive load bank and make temporary connections for full load test.
- C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel. The authority having jurisdiction shall be given advance notice to witness the test.
- D. Manufacturer shall include costs for testing and shall pay all costs.
- E. A full load test shall be initiated immediately after the cooling time in accordance with NFPA 110 requirements.
- F. The acceptance test shall be made available to the authority having jurisdiction, along with a letter of compliance.

2.12 TRAINING

- A. The equipment supplier shall provide Owner training covering operation and maintenance of the equipment provided. The training program shall be a minimum of (3) separate training sessions on different dates. Training date shall be coordinated with the facility owner.
 - Provide (1) training session at commissioning.
 - Provide (1) training session at the end of 12-month inspection and maintenance.
 - Provide (1) training session at the end of warranty period.

2.13 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.
- B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

2.14 REMOTE ANNUNCIATOR

- A. Remote annunciator shall meet NFPA 110 Level 1, Type 10 requirements.
- B. RS 485 ModBus.
- C. LED indicating for status. Warning and/or shutdown for NFPA 110 compliant.
 - 1. High engine temperature warning.

2. Low coolant level/aux shut down.
3. Low cranking voltage.
4. Low oil pressure shut down
5. Over crank shut down
6. Over speed shut down.
7. Audible alarm silence
8. Lamp test
9. Master switch not-in-auto.

D. Belden 9729 and 2#14's for the remote annunciator unless noted otherwise.

2.15 REMOTE EMERGENCY STOP STATION

A. As scheduled on the drawings.

2.16 START WIRE MONITOR UNIT

A. Provide a monitoring unit compliant to 2023 NEC. ASCO 5101 or equal or as scheduled on the drawings.

2.17 OIL CONTAINMENT SYSTEM

A. Oil containment system for compliance to 2018 NFPA 37 for roof installation.

PART 3 OPERATION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Confirm all dimensions and coordinate with general trades for concrete pad outside of building.
- C. Provide complete power wiring between panels, generator and transfer switches.
- D. Wire the remote annunciator and e-stop as specified and noted on the drawings.
- E. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products
- F. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- G. Graded mount equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

- H. Equipment shall be initially started and operated by representatives of the manufacturer.
- I. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
- J. Roof mounted generator shall be installed and secured on the roof support framing. Refer to structural drawings for support details.
- K. Complete start wire monitoring unit installation in accordance with the manufacturer's requirements.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide onsite system commissioning for initial startup, check out, running operation and load testing.

3.3 SYSTEM TRAINING

- A. Include (3) onsite Owner training sessions as specified.

3.4 MAINTENANCE

- A. The generator vendor shall provide the Owner a maintenance list to be performed during the warranty period.
- B. Submit maintenance proposals for the Owner's review and consideration. Submit a 2 year quote and a 5 year quote.

END OF SECTION

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SECTION 26 43 13

SURGE PROTECTIVE DEVICES FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Surge protective device.

1.2 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.3 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.4 REFERENCES

- A. UL 1449 4th Edition listing and classification and clamping voltages.
- B. ANSI/IEEE C62.41/62.45 certified documentation of performance testing.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

1.5 SUBMITTALS

- A. Provide submittals as listed in Section 26 01 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. As scheduled on the drawings.
- B. Service Entrance, Mdp and Panelboard Surge Protective Devices
- C. SPD Description: Units shall have the following features and accessories:
 - 1. Engineered solid state arrays of nonlinear voltage dependent individually fused and thermally protected metal oxide varistors with matched operating characteristics.

2. The suppression system shall not utilize silicon avalanche diodes (SADs), selenium cells or other components which might short circuit the line, leading to interruption of normal power.
 3. Short circuit current rating: 200 kAIC.
 4. Nominal Discharge Current Rating: 20 kA $I_{(n)}$.
 5. Internal connections: All full magnitude transient currents shall be conducted utilizing low impedance copper bus bars.
 6. Fabrication using bolted compression lugs for internal wiring.
 7. Redundant suppression circuits.
 8. Red and green LED indicator lights for power and protection status.
 9. Audible alarm to indicate when protection has failed.
 10. Surge event operations counter (Service Entrance device requirement only).
 11. Form C contacts; one normally open and one normally closed for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
- D. Peak Surge Current Rating for Service Entrance devices: 240 kA per phase.
- E. Peak Surge Current Rating for Distribution Panel devices: 150 kA per phase.
- F. Peak Surge Current Rating for Branch Panelboard devices: 100kA per phase.
- G. UL 1449 4th Edition Voltage Protection Rating (VPR) shall be as follows:
1. Line to Neutral:
 - a. 208Y/120: 700V
 2. Line to Ground:
 - a. 208Y/120: 700V
 3. Neutral to Ground:
 - a. 208Y/120: 700V
 4. Line to Line:
 - a. 208Y/120: 1200V

2.2 SERVICE CONDITIONS

- A. Rate SPDs for continuous operation under the following conditions unless otherwise indicated:
- B. Maximum Continuous Operating Voltage per UL 1449 4th edition:
 1. 208Y/120: 25% allowable fluctuation, 150V
- C. Operation Temperature: 0 to 120 deg F
- D. Humidity: 0 to 95%, non-condensing.
- E. Altitude: Less than 10,000 feet above sea level.

2.3 ENCLOSURES

- A. The specified system shall be provided in a NEMA-rated enclosure suitable for the

environment.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Conductors between suppressor and point of attachment to service equipment shall be sized in accordance with manufacturer's recommendations and conductor lengths shall be as short as possible, not to exceed 36 inches for Service Entrance and 18 inches for Distribution and Branch Panels. Do not bond neutral and ground.

3.2 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.

3.3 FIELD QUALITY CONTROL

- A. Verify that electrical wiring installation complies with manufacturer's installation requirements.

END OF SECTION

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SECTION 26 45 23

ELECTROMELT SNOWMELT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes a UL Listed and CSA Certified snow melting heat tracing system consisting of mineral insulated heating cable, connection kits and electronic controller.

1.2 SYSTEM DESCRIPTION

- A. System for snow melting with temperature and moisture sensing control, monitoring, integrated ground-fault circuit protection and Building Management System (BMS) communication capabilities.

1.3 SUBMITTALS

- A. Product Data
 - 1. Heating cable data sheet
 - 2. UL, CSA approval certificates for snow melting
 - 3. Snow melting design guide
 - 4. System installation and operation manual
 - 5. System installation details
 - 6. Connection kits and accessories data sheet
 - 7. Controller/Power Panel data sheet
 - 8. Controller/Power Panel wiring diagram

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications
 - 1. Manufacturer to show minimum of thirty (30) years experience in manufacturing mineral insulated (MI) heating cables.
 - 2. Manufacturer will be ISO-9001 registered.
 - 3. Manufacturer to provide products consistent with UL 515, CSA 22.2 No 130-03 and IEEE 515.1 requirements.
- B. Installer Qualifications
 - 1. System installer shall have a complete understanding of product and product literature from manufacturer or authorized representative prior to installation. Electrical connections shall be performed by a licensed electrician.

- C. Regulatory Requirements and Approvals
 - 1. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory (NRTL), and marked for intended use.

1.5 DELIVERY, STORAGE AND HANDLING

- A. General Requirements: Deliver, store and handle products to prevent their deterioration or damage due to moisture, temperature changes, contaminates or other causes.
- B. Delivery and Acceptance Requirements: Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:
 - 1. Product and Manufacturer
 - 2. Length/Quantity
 - 3. Lot Number
 - 4. Installation and Operation Manual
 - 5. MSDS (if applicable)
- C. Storage and Handling Requirements
 - 1. Store the heating cable in a clean, dry location with a temperature range 0°F (-18°C) to 140°F (60°C).
 - 2. Protect the heating cable from mechanical damage.

1.6 WARRANTY

- A. Extended Warranty
 - 1. Manufacturer shall make available a ten (10) year limited warranty for MI heating cables and components. Provide one (1) year warranty for all heat trace controllers.
 - 2. Contractor shall submit to owner the results of all installation tests required by the manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

- A. Contract Documents are based on manufacturer and products named below to establish a standard of quality.

B. Basis of Design

1. Basis of Design Product Selections

a. Manufacturer

1. Manufacturers shall have more than thirty (30) years experience with manufacture & installation MI heating cables.
2. Manufacturer shall provide UL and CSA approval certificates for snow melting.
3. Manufacturer shall be Chemelex LLC

b. Snow Melting System

1. Pyrotenax MI heating cable
2. APS-4C and SC-40 snow/icing melting controller
3. Snow Owl Aerial Moisture Sensor
4. Thermistor Temperature Sensor Embedded in slab

2.2 PRODUCTS, GENERAL

- A. Single Source Responsibility: Furnish heat tracing system for snow melting from a single manufacturer.
- B. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting. No parts of the system may be substituted.

2.3 PRODUCTS

A. HDPE Jacketed Copper Sheathed Mineral Insulated Heating Cable

1. Heating cable shall be Pyrotenax MI heating cable manufactured by Chemelex LLC.
2. The heating cable shall consist of a single conductor surrounded by magnesium oxide insulation with a solid, seamless copper sheath.
3. The heating cable shall have an extruded high density polyethylene (HDPE) jacket to protect the cable from corrosive elements that can exist in the concrete.
4. The heating cable shall be factory terminated with a minimum 7 foot cold lead (unheated) length.
5. The heating cable shall operate on line voltages of 208, 240 without the use of transformers.
6. The heating cable shall be part of a UL Listed and CSA Certified system.
7. The MI heating cable tag shall have the following markings:
 - a. Complete heating cable model number
 - b. Agency listings
 - c. Serial Number
 - d. Lot/Batch ID

- B. Heating Cable Installation Accessories
 - 1. Pre-punched strapping – Used to maintain proper spacing of the MI heating cable during installation. (Catalog Number: SPACER-GALV)
 - 2. Junction Box – The junction box is a cast aluminium junction box (NEMA 3) for installation in non-hazardous and C1D2 locations. There are three (3) ½” NPT entries on the bottom, provided with plugs, and includes a 4-pole terminal block. (Catalog Number: MIJB-1086B)
 - 3. Snow Melting Caution Sign – The snow melting caution sign is required by national electrical codes to indicate that an electrical snow melting system is installed in the slab. (Catalog Number: SMCS)
- C. Control Methodology
 - 1. Single Circuit Control
 - a. Single circuit snow/ice melting controller shall be APS-4C.
 - b. Heating cable manufacturer shall provide a single circuit snow/ice melting controller with built-in GFPD compatible with selected heating cable.
 - c. Electronic snow/ice melting controller shall have a GFPD with adjustable trip levels of 30, 60, and 120 mA.
 - d. Electronic snow/ice melting controller shall have 50-A (APS-4C 208 – 240 V single phase switching capacity rating.
 - e. Electronic snow/ice melting controller shall be capable of operating with supply voltages of 208 – 240 V three phase (APS-4C)
 - f. Electronic snow/ice melting controller shall be capable of supporting up to six (6) type Snow Owl aerial and/or type SIT-6E slab mounted temperature and moisture sensors.
 - g. Enclosure type shall be NEMA 3R polycarbonate.
 - h. Electronic snow/ice melting controller shall have an adjustable hold-on timer (0 – 10 hours).
 - i. Electronic snow/ice melting controller shall have an integrated high-limit temperature sensor.
 - j. Electronic snow/ice melting controller shall have contacts (10-mA dry switch contact) to interface with an Energy Management Computer (EMC).
 - 1. Inputs: Override On, Override Off
 - 2. Outputs: Supply, Snow, Heat, High Temp, Alarm
 - k. Digital controller shall have c-UL-us approvals.

2.4 SYSTEM LISTING

- A. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting.
- B. The snow melting system shall have design and installation & operating manuals.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

- A. Subject to compliance with requirements of Contract Documents, installer shall be familiar with installing heating cable and equipment.

3.2 INSTALLATION

- A. Comply with manufacturer's recommendations in the Surface Snow Melting - MI Installation and Operation Manual (H57754).
- B. Install and secure the heating cable in accordance with the Surface Snow Melting - MI Installation and Operation Manual (H57754).
- C. Install electric heating cable according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a complete functional system, installed in accordance with applicable national and local requirements.
- D. Grounding of controller shall be equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connection of all electrical wiring shall be according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Start-up of system shall be performed by factory technician or factory representative per the owner's requirements.
- B. Field Testing and Inspections
 - 1. The system shall be commissioned in accordance to the Surface Snow Melting - MI Installation and Operation manual.
 - 2. The heating cable circuit integrity shall be tested using a 1000 Vdc megohmmeter at the following intervals below. Minimum acceptable insulation resistance shall be 20 megohms.
 - a. Before installing the heating cable
 - b. Continuously during concrete or asphalt pour
 - c. After concrete or asphalt pour is complete
 - d. Prior to initial start-up (commissioning)
 - e. As part of the regular system maintenance
 - 3. The technician shall verify that the APS-4C snow/icing melting controller control parameters are set to the application requirements.

4. The technician shall verify that the APS-4C snow/icing melting controller alarm contacts are correctly connected to the BMS if applicable.
5. All commissioning results will be recorded and presented to the owner.

3.4 MAINTENANCE

A. Maintenance Service

1. Comply with manufacturer's recommendations in Surface Snow Melting - MI Installation and Operation Manual.

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior luminaires per schedule.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
- B. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- C. NFPA 101 - Life Safety Code, current adopted edition.
- D. 2021 Michigan Energy Code.
- E. ASHRAE 90.1 2019 Edition.
- F. LED Standards LM 79 and LM 80.

1.4 SUBMITTALS FOR REVIEW

- A. Provide submittal as listed in Section 26 01 00.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.

- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.
- D. 2021 Michigan Energy Code.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Furnish Products as scheduled on the drawings.

2.2 LED DRIVERS

- A. LED drivers shall include a factory disconnecting means in accordance with 2023 NEC 410-130G.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Support luminaires independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips at a minimum of (4) points of attachment to prevent movement.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Install clips to secure recessed grid-supported luminaires in place at a minimum of (4) points of attachment to prevent movement.
- I. Install wall mounted luminaires at height as indicated on Drawings and/or architectural drawings.
- J. Install accessories furnished with each luminaire.

- K. Connect emergency luminaires and exit signs to the emergency distribution or inverter as noted and shown on the drawings.
- L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Luminaires specified with factory installed battery drivers shall be wired as noted and shown on the drawings.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Contract Closeout: Division 1: Adjusting installed work.
- B. Aim and adjust luminaires as indicated or as directed.
- C. Position exit sign directional arrows as indicated.

3.4 CLEANING

- A. Contract Closeout: Cleaning installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

- A. Replace light fixtures with non-working LED's, broken or discolored lens.

3.6 PROTECTION OF FINISHED WORK

- A. Contract Closeout: Protecting installed work.

3.7 SCHEDULES

- A. Refer to Drawings.

END OF SECTION

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SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Exterior luminaires and accessories.
- B. Poles.
- C. Watertight wiring connectors.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. LED Standards LM 79 and LM 80.
- B. ANSI O5.1 - Specifications and Dimensions for Wood Poles.
- C. IES 10th Edition.
- D. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- E. 2021 Michigan Energy Code.

1.4 SUBMITTALS FOR REVIEW

- A. Provide submittal as listed in Section 26 01 00.
- B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 Michigan Electrical Code Rules Part 8, 2017 ICC/ANSI A117.1 and local code requirements.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.
- C. Michigan Uniform Energy Code.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Material and Equipment: Transport, handle, store, and protect products.
- B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.7 COORDINATION

- A. Coordination, refer to Division 1.
- B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 PRODUCTS

2.1 LUMINAIRES AND ACCESSORIES

- A. Furnish Products as scheduled on the drawings.

2.2 POLES

- A. As scheduled on drawings.

2.3 WATERTIGHT WIRING CONNECTORS.

- A. Furnish removal connector assembly either fused or non-fused.
- B. Provide in-line connector type for single circuit application.
- C. Provide Y type connector to permit splitting of the circuit.
- D. Acceptable manufacturers for in line or y connectors: Buchanan 84, 65 Series or equal by Homac.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide concrete bases for lighting poles at locations indicated, Electrical Contractor shall furnish.

- B. Install poles plumb. Provide shims or double nuts to adjust plumb. Grout around each base. The manufacturer's anchor bolts and templates to assist the General Trades with the concrete base installation.
- C. Anchor bolts and templates shall be furnished by the manufacturer. Setting of the anchor bolts shall be the contractor's responsibility for a properly positioned pole/fixture assembly to be perpendicular to the curb or walkway edge.
- D. Install lamps in each luminaire.
- E. Bond luminaires to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.
- F. Cutting of the anchor bolts to make light pole corrections in the field is not permitted. Contact the Structural Engineer for review and assistance.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- B. Measure illumination levels to verify conformance with performance requirements.
- C. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.3 ADJUSTING

- A. Contract Closeout: Adjusting installed work, refer to Division 1.
- B. Aim and adjust luminaires to provide illumination levels and distribution as specified.

3.4 CLEANING

- A. Contract Closeout: Cleaning installed work, refer to Division 1.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- A. Contract Closeout: Protecting installed work, refer to Division 1.
- B. Relamp luminaires which have failed lamps at Substantial Completion.

3.6 SCHEDULE

A. Refer to drawings.

END OF SECTION

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SECTION 28 46 13

FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. New point addressable main fire alarm/burglary alarm control panel, devices, and new NAC panels.
 - 1. Fire alarm system performance specification.
 - a. Contractor shall be responsible to obtain engineering and AutoCAD from the fire alarm manufacturer to design a new system. Devise an existing system and install a complete fire alarm system.
 - b. Contractor shall submit and pay all fees for plan review, 50% inspection, final inspection and complete and submit all associated documents.
 - c. Contractor shall be responsible for system check-out, start-up and on-site Owner training.
- B. Fire alarm system shall not be limited to: Manual pull stations, magnetic door holders, duct smoke detectors, ceiling smoke detectors, ceiling heat detectors, remote annunciator panel/keypad, audio/visual devices and visual devices. Include all associated code mandated components, wiring for a complete operating system.
- C. Fire alarm ADA signaling devices.
- D. Fire alarm wiring.
- E. Unit Prices: Provide a unit price for complete device installation as listed: Manual pull stations, audio/visual devices, smoke detectors ceiling heat detectors, remote annunciator panel/keypad, duct smoke detectors, conduit, backboxes and wiring. Refer to the Bid Proposal Form for associated requirements.
- F. Combination smoke/fire dampers shall be furnished and installed as part of Mechanical Trades bid. It shall be the responsibility of the Electrical Trades to review the mechanical drawings for damper locations. Do not rely solely on the electrical drawings.
- G. Fire protection system. Electrical Trades shall complete all flow and tamper switch wiring to the fire alarm system. The flow and tamper switches shall be furnished and installed as part of the fire protection contractor's bid. Electrical Trades shall furnish and install a flush mounted backbox, an exterior horn/strobe and wiring to the fire alarm system. Electrical Trades shall be responsible to contact the fire protection contractor to confirm flow and tamper switch quantities and locations, and include all costs.

- H. The fire alarm vendor shall be responsible to review the Architectural door schedules and hardware specification section to include all magnetic door holder devices. Include all fire alarm panel points.
- I. The Fire Alarm vendor shall include in their bid any cost for requesting AutoCAD backgrounds for their use from the Architect or Engineer. The cost will be \$150.00 for the first plan, and \$50.00 for each additional plan that may be requested for AutoCAD use. A waiver of responsibility for the Architect and Engineer related to Contractor use of the CAD files shall be signed by the Fire Alarm vendor.
- J. Fire alarm system interface to egress lighting to meet Chapter 7 Life Safety Code Article 7.8 requirements.

1.2 RELATED SECTIONS

- A. All drawings and specification sections apply to work in this section. Furnish all items, articles, materials, equipment, operations or methods that are mentioned, listed or scheduled on drawings or are in this specification including all labor, equipment, materials and miscellaneous incidentals necessary and/or required for the completion of this project. The work covered under this section of the specifications is in no way complete within itself but is supplementary to the entire specification and drawings.

1.3 REFERENCES

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 State of Michigan Code Rules Part 8, 2017 ICC/ANSI 117.1 and local code requirements.
- B. NFPA 72 - Current adopted code.
- C. State of Michigan – Bureau of Fire Services for Fire Alarm Plan Review and Inspections.
- D. Local authorities having jurisdiction.
- E. State of Michigan, 2016 School Rules.
- F. Underwriters Laboratories Inc.
- G. National Fire Protection Association Standards
 - 1. NFPA 13 – Installation of Sprinkler Systems.
 - 2. NFPA 15 – Water Spray Fixed Systems.
 - 3. NFPA 16 – Deluge Foam Water Systems.
 - 4. NFPA 72 – National Fire Alarm Code.
 - 5. NFPA 101 – Life Safety Code.
 - 6. NFPA 720 – Standard for Installation of CO Detection.
- H. All equipment shall be approved by Underwriters Laboratories Inc. (UL) for its intended purpose for the following standards as applicable.

1. UL864 UOJZ - Control units for fire protective signaling systems local signaling unit.
 - a. Central station signaling protected premises unit.
 - b. Remote signaling protected premises unit.
2. UL2075 - CO detectors connected to face.
3. UL864 SYZV - Releasing device control unit (water release only).
4. UL268 - Smoke detectors for fire protective signaling systems.
5. UL268A - Smoke detectors for duct application.
6. UL217 - Smoke detectors for single stations.
7. UL521 - Heat detectors for fire protective signaling systems.
8. UL228 - Door holders for fire protective signaling systems.
9. UL464 - Audible signaling appliances.
10. UL1638 - Visual signaling appliances.
11. UL38 - Manually activated signaling boxes.
12. UL346 - Waterflow indicators for fire protective signaling systems.
13. UL1481 - Power supplies for fire protective signaling systems.

1.4 AMERICANS WITH DISABILITIES ACT (ADA)

- A. All visual notification appliances and manual pull stations shall comply with the requirements with ADA.

1.5 SUBMITTALS

- A. Provide submittal as listed in Section 26 01 00. Submittal cut sheets shall be arrowed or marked with catalog numbers. Failure to comply will be cause for returning submittal for corrections at no delays or extra cost to the Owner.
 1. Plan drawings showing the locations (with room names and numbers) of the system components, including any adjustments in the quantities and locations of initiating devices and notification appliances to meet code requirements.
 2. Riser diagram showing system components, interconnecting wiring and connections to other building systems and equipment.
 3. Wiring diagrams showing manufacturer and field connections at component terminals, complete with conductor color codes and wire numbers.
 4. System configuration list showing inputs, outputs, device addresses and custom location labels, device configurations and program logic.
 5. Submit bill of materials, and not part of the submittal, with O&M Manuals.
 6. Catalog pages showing system components.
 7. System battery sizing calculations.
 8. Power supply, amplifier and circuit sizing calculations.
 9. Door hold-open power supply sizing calculations.
- B. Shop Drawings: Provide control panel layout and system wiring diagram showing each device and wiring connection required.

1.6 PROJECT RECORD DOCUMENTS

- A. Record actual locations for complete fire alarm system.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit as specified.
- B. Operation Data: Operating instructions.
- C. Maintenance Data: Maintenance and repair procedures.

1.8 REGULATORY REQUIREMENTS

- A. Conform to requirements of 2021 Michigan Building Code, 2023 National Electrical Code, 2023 State of Michigan Code Rules Part 8, 2009 ICC/ANSI 117.1 and local code requirements.
- B. NFPA 72 - Current adopted edition.
- C. NFPA 101 - Life Safety Code, current adopted edition.
- D. State of Michigan, Bureau of Fire Services for Plan Review and Inspections.
- E. Local authorities having jurisdiction.
- F. State of Michigan, 2016 School Rules.
- G. NFPA 90A Current Adopted Edition.
- H. NFPA 92A Current Adopted Edition.
- I. NFPA 92B Current Adopted Edition.
- J. All equipment shall be approved by Underwriters Laboratories Inc. (UL) for its intended purpose for the following standards as applicable.
 - 1. UL864 UOJZ - Control units for fire protective signaling systems local signaling unit.
 - a. Central station signaling protected premises unit.
 - b. Remote signaling protected premises unit.
 - 2. UL2075 - CO detectors connected to face.
 - 3. UL864 SYZV - Releasing device control unit (water release only).
 - 4. UL268 - Smoke detectors for fire protective signaling systems.
 - 5. UL268A - Smoke detectors for duct application.
 - 6. UL217 - Smoke detectors for single stations.
 - 7. UL521 - Heat detectors for fire protective signaling systems.
 - 8. UL228 - Door holders for fire protective signaling systems.
 - 9. UL464 - Audible signaling appliances.
 - 10. UL1638 - Visual signaling appliances.
 - 11. UL38 - Manually activates signaling boxes.
 - 12. UL346 - Waterflow indicators for fire protective signaling systems.
 - 13. UL1481 - Power supplies for fire protective signaling systems.

1.9 SCOPE OF WORK

- A. This bid package shall include fire alarm panel/burglary alarm control panel , all devices and associated NAC panel, wiring and system certification ready for

interconnection to one main fire alarm control panel, a remote annunciator panel as specified, and tie into the existing fire alarm devices. New panel shall replace existing Bosch fire alarm control panel and tie into existing fire alarm devices.

- B. Provide fire alarm wiring and a 120 volt circuit to any combination smoke/fire dampers as shown on the Mechanical drawings. Electrical Trades shall be responsible to review the Mechanical drawings in addition to the Electrical plans. Mechanical plans shall govern damper location. Interwire to the associated duct smoke detector in accordance with the manufacturer's wiring instructions. Duct smoke detector shall be provided and wired by Electrical Trades, unless specifically listed on the damper schedules.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. JCI/Simplex, Siemens, National Time, Honeywell, Gamewell or Edwards.
- B. Non-proprietary manufacturers Kidde, Firelite, Silent-Nite or Honeywell.
- C. Engineered service distribution (ESD) is not a requirement with non-proprietary system.

2.2 OPERATION

- A. The operation of any manual pull station, flow switch, tamper switch, smoke detector, duct smoke detector, shall cause the sounding of all alarm horns on a temporal pattern basis, sequential flashing of system strobes, activate common alarm relay contacts on the control panel and indicate on the control panel's LCD display the zone and type of device sounding the alarm.
- B. In addition, the operation of any duct smoke detector shall shut down its associated fan or damper motor. Complete interwiring between detector and mechanical equipment control panel.
- C. Refer to the current adopted NFPA 72 Fire Alarm Code for the allowable detector distance and location from the pair of doors.
- D. The operation of the panel mounted alarm silencing switch will turn off all horns but the strobes will continue to flash until the device actuating the alarm is reset to its normal position and the panel mounted system reset button is operated, at which time the system will return to its normal stand by (supervisory) mode.
- E. Any system trouble condition such as an open circuit or ground condition will activate a common trouble LED and indicate on the control panel LCD display the exact zone, circuit or internal panel condition causing the trouble condition. Correction of the trouble source will return the panel to its normal standby mode.
- F. Initiating device circuits shall be two-wire style B, and horn or strobe circuits shall be two-wire style Y utilizing end of line resistors for circuit supervision. All wiring to

initiating and signaling devices shall be looped and continuous to the end of line resistor on its respective circuit. T-tapping is not permissible.

- G. The fire alarm control panel shall communicate with each addressable initiating and control device individually via shielded twisted pair signaling line circuits.
- H. Each signaling line circuit shall be capable of accessing up to 127/250 addressable devices.
- I. Each signaling line circuit shall allow up to 10,000 feet of wire length to the furthest addressable device.
- J. Communications shall be completely digital and shall include parity data bit error checking routines for address codes and check sum routines for the data transmission protocol.
- K. Each device shall be uniquely identified by the device address.
- L. There shall be no limit to the number of initiating devices which may be activated simultaneously.
- M. Each device shall be individually annunciated at the panel. Annunciation shall include the following conditions for each device.
 - 1. Alarm, supervisory or trouble condition.
 - 2. Open, short or ground.
 - 3. Device failure or incorrect device installed.

2.3 FIRE ALARM CONTROL PANEL/BURGLARY ALARM CONTROL PANEL

- A. New point addressable suitable for non-voice evacuation sized properly with a minimum of 30% spare capacity and burglary alarm system. System shall be compatible with existing notification devices to replace existing Bosch fire alarm control panel.
- B. Honeywell #VISTA-128FBPT OR EQUAL
- C. Provide a fire alarm control panel with the following:
 - 1. Digital display.
 - 2. Multiple pushbutton keypad.
 - 3. LED status indicating lights.
 - 4. Audible status signals.
 - 5. Output relays.
 - 6. Battery charger and batteries.
 - 7. RS-232 communications card.
 - 8. Integrated burglary system
- D. Evaluate and document the appropriate notification appliance circuit class designation.
 - 1. In general, provide Class B notification appliance circuits.

2. Size the control panel power supplies, amplifiers, and batteries for 25 percent spare capacity calculated with, 1 watt speaker loads, and 150 ma strobe light loads.
 3. Provide sufficient spare capacity on each notification appliance circuit for an additional 25 percent of notification appliances.
- E. The system shall supervise the following circuits and components:
1. Initiating device circuits.
 2. Signaling line circuits.
 3. Notification appliance circuits.
 4. Addressable initiating and control devices.
 5. Control output wiring.
 6. Auxiliary control switches.
 7. System, NAC panels, remote annunciator, keypads.
 8. Primary power supply.
 9. Secondary power supply.
- F. The system shall be capable of being programmed by the Owner on site to accommodate expansion or sequence of operation changes.
- G. Provide 120 volts AC primary power to the system.
- H. Provide a control panel battery charger capable of fully charging a 200 amp-hour battery within 24 hours.
- I. Provide sufficient secondary power battery capacity to operate the entire system (except the door hold-open devices) upon the loss of primary power for a period of 24 hours in a normal supervisory mode followed by 5 minutes of evacuation alarm operation.
1. When emergency voice/alarm communications is provided, provide sufficient battery capacity for 24 hours of operation in a normal supervisory mode followed by 15 minutes of voice/alarm operation.
 2. The system shall automatically transfer to and from the secondary power batteries upon an interruption of primary power without initiating a nuisance alarm.
 3. The system shall delay initiating a trouble condition for two seconds upon a transfer to or from primary power to avoid nuisance trouble conditions during emergency generator testing.
- J. Provide smoke and heat detectors as required by code and as shown, including the following.
1. Provide a smoke detector in each mechanical, electrical, telecommunications, daycare rooms, and associated egress corridors.
 2. Provide duct smoke detectors where required by code. When not in plain view or when more than 10 feet above the floor, provide duct detector remote alarm indicators and test switches mounted in plain view at 48 inches above the floor.

- K. Provide sufficient audible notification appliances to achieve a sound level of 15 dBA above ambient sound level, but not less than 60 dBA nor more than 110 dBA in all occupiable spaces. The sound level in mechanical rooms shall be not less than 90 dBA. The sound shall be a three-pulse temporal pattern evacuation tone.
- L. Provide visual notification appliances in accordance with the intensity and spacing requirements of NFPA 72.
 - 1. Provide speaker/strobes in accordance with plans and specifications.
 - 2. Synchronize strobes.
- M. Provide individually addressable monitor modules to monitor non-addressable initiating devices and status contacts of other systems.
 - 1. Monitor modules shall use Class B initiating device circuits to monitor the initiating devices and status contacts.
- N. Provide panel auxiliary relay contacts and individually addressable control module contacts, including the required panel control logic programming, to interface with control circuits of other systems and equipment.
 - 1. Provide normally closed duct smoke detector contacts to shut down ventilation systems.
- O. Assign each initiating device and control module a unique device address. Label each device with its unique address using a clear adhesive backed nylon or Mylar tape with black text. Install the label on the base of any device with a removable or replaceable head.
- P. Label each initiating device and control module that describes the type, room number/name and exact location of the device.
- Q. Provide transient voltage surge suppression for the system.

2.4 DEVICES (all point addressable type that is compatible to the main panel)

- A. **Manual Pull Stations:** Individually addressable, suitable for two wire operation, with a high impact red Lexan body and raised white lettering. Stations shall include an ADA compliant single action operating mechanism with a mechanical latch to hold an operated station open until reset.
 - 1. Reset shall be accomplished through use of a key common to the panel or a small flat-blade screwdriver. Stations which use allen wrenches or special tools to reset are not acceptable. The point of reset shall be front accessible so stations with tamper-resistant covers can be reset easily.
- B. **Smoke Detectors:** Provide photoelectric type with two wire base for mounting to a 4" octagon box. Furnish smoke detectors for control of the magnetic door holder as shown and noted on the plans. Refer to the current adopted NFPA 72 Fire Alarm Code for the allowable detector for locations.

- C. **Duct Smoke Detectors:** Individually addressable and consist of a housing, sampling tubes, a baffle and a detachable detector head. Duct detectors shall include an alarm LED, a local test switch, and an auxiliary SPDT relay for ventilation system control. Duct detectors shall be resettable by actuating the panel reset pushbutton. The sampling tubes shall be capable of being cleaned through the housing cover.
 - 1. The detector heads shall be photoelectric as specified above, but shall be capable of accepting ionization detector heads.
 - 2. Duct detectors shall include remote alarm indicators and test switches shall be installed in readily accessible locations.
- D. **Audio/Visual Units:** Provide horn and strobe units with 24VDC horn and ADA approved strobe for mounting to a 4" square box.
- E. **Strobes:** As shown for proper illuminance, clear Lexan lens with red "FIRE" or international fire symbol lettering, capable of being synchronized, and capable of wall or ceiling mounting.
- F. **Magnetic Door Holder:** Flush wall unit. Minimum 25 pound holding force, 120 volt operation. Furnish addressable relay for each pair of doors, also include the door plate with holder assembly. Refer to door hardware schedule for additional project requirements, and for holder type. The schedule shall govern and the holders shall be provided, installed and wired to the fire alarm panel.
- G. **Audio/Visual and Visual Units:** For ceiling installation shall include vertical lettering. Horizontal lettering is not acceptable.
- H. Fire alarm panel contact for egress lighting interface to meet Chapter 7 Life Safety Code Article 7.8 requirements.

2.5 FIRE ALARM WIRING

- A. Use (1) pair #18/2 twisted shielded for initiating devices unless directed otherwise by the manufacturer.
- B. Use (1) pair #14 for power duct smoke detectors as directed by the manufacturer.
- C. Use (1) pair #14 for horn/strobe circuits as directed by the manufacturer.
- D. Use (2) pair #18 for control to remote alarm and test station with duct smoke detector.
- E. All fire alarm wiring shall be in compliance with NEC Article 760.
- F. Magnetic door holder wiring. Furnish addressable relay for each pair of doors. Interwire the door holder to the main fire alarm panel. Complete the associated ceiling smoke detectors wiring to the holders and to the main fire alarm system.

- G. Fire alarm supplier to provide circuiting to comply with voltage drop and load calculations per Code requirements.
- H. All wire sizes indicated are minimum.

2.6 NAC PANEL

- A. Node and NAC panels shall be modular with solid state, microprocessor based electronics, operator interfaces, power supplies, audio generators, amplifiers, battery chargers and batteries as required. All components shall be supervised.
- B. Fire alarm vendor/manufacturer shall be responsible for determining the required quantity and location.
- C. Honeywell #HPF-PS10, BAT-12180-BP or EQUAL

2.7 POWER SUPPLIES

- A. Fire alarm vendor shall furnish and install power supplies as required for a complete operating system. Electrical Trades shall field select the location as advised by the fire alarm vendor.

2.8 REMOTE ANNUNCIATOR

- A. The remote annunciator shall duplicate the backlit LCD display; the alarm acknowledge, supervisory acknowledge, trouble acknowledge, alarm silence, and system reset pushbuttons; the alarm, supervisory, and trouble audible signals; the alarm, supervisory, trouble, and power "on" LED's; and the programmable function keys of the fire alarm control panel. A key "enable" switch or door lock, keyed to match the fire alarm control panel door lock, shall permit activating or deactivating the controls. Security alarm, status, and police push button.
- B. Honeywell #6160CR-2 or EQUAL

2.9 BATTERIES

- A. Batteries shall be lead calcium and supervised so that a failure produces a "TROUBLE" signal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. New fire alarm/security control panel shall replace existing Bosch Fire alarm panel. Existing notification devices shall be tied into new fire alarm system
- B. Install fire alarm wiring in conduit for device shown storage room, mechanical rooms and similar space. Use 5'-0" minimum conduit drop in for physical protection.

- C. All junction boxes for fire alarm raceway system shall be painted red labeled "FIRE ALARM". Junction boxes installed in theatrical space where the project requires a black room finish scheme, label the junction box "fire alarm".
- D. Provide and install the fire alarm system in strict accordance with the plans and specifications, codes and manufacturer's instructions.
- E. Fully test the fire alarm system in accordance with NFPA 72, Chapter 7.
- F. Fire alarm vendor shall be responsible to certify the sound coverage for the entire facility.
- G. Audio/visual and visual units shall be installed in accordance with Michigan Building Code under the fire protection system section or NFPA 72 Fire Alarm Code wall mounted appliance shall be mounted such that the entire lens is not less than 80 inches, and not greater than 96 inches above the finished floor. Ceiling mounted device is an acceptable method. Ceiling mounting devices are designated with a C subscript letter.
- H. Manual pull stations shall be mounted a maximum of 48" from the floor level to the activating handle or to the lever. The current adopted Michigan Building Code edition fire protection system Section 907 shall govern over NFPA 72 Fire Alarm Code for mounting heights.
- I. Electrical Trades shall complete the entire fire alarm system in accordance with plans and specifications.
- J. Electrical Trades to install the door plate as part of the door holder installation. Mount the plate to hollow metal door. Do not use thru-bolts. The door hardware schedule and the specified architectural installation methods for use by the hardware installer shall govern over the door plate described method.
- K. All fire alarm wiring installation that may be required to be installed through non-accessible ceiling spaces, and cannot be installed in conduit or cable tray, free air method will be acceptable for those spaces. Open wiring is acceptable method. Properly secure to ceiling structure, use J hooks or D-rings. The cable shall be plenum rated for this application.
- L. Ceiling mounted fire alarm device locations are shown diagrammatic. The design requirement shall be to install the device centered in the classrooms, corridor, offices, etc. Confirm the location with lighting, speaker, HVAC diffusers, to avoid interferences.
- M. NAC panel(s) require a dedicated 120 volt power source. The Contractor shall be responsible for coordinating NAC panel quantities and locations with their fire alarm vendor and include all power circuit costs in the bid.
- N. Electrical Trades and their respective fire alarm vendor shall field determine the remote duct detector test station location to maintain easy access for the Owner usage. The test station locations are not shown on the drawings.

- O. Contractor shall be responsible to wire tamper switch to the fire alarm panel. Include fire alarm panel points as part of the overall fire alarm panel points.
- P. Electrical Trades shall complete all fire alarm interface wiring to coiling shutter doors, food service fire suppression system connections, at all sprinkler riser locations. Exterior horn/strobe associated with exterior fire protection fire department hose connections/flow and tamper switches.
- Q. Electrical Trades shall furnish and install a circuit breaker lock for the 120 volt circuit serving the fire alarm panel. Label the panelboard directory branch circuit text in red.
- R. Complete interface wiring from fire alarm panel to egress lighting.

3.2 MANUFACTURER/DISTRIBUTOR SERVICES

- A. The following supervision shall be provided by a factory trained service technician from the distributor of the fire alarm equipment.
- B. A pre-installation visit to the job site to review equipment submittals and to verify the method by which the system is to be wired.
- C. Upon completion of wiring, final checkout and certification of the system shall be made under supervision of this technician.
- D. At that time of the formal checkout, technician shall give operational instructions to the Owner.

3.3 WARRANTY

- A. Provide a one-year guarantee from date of system acceptance by the Owner.

3.4 CLOSE-OUT

- A. Provide O&M manuals, warranty letter, as-built drawings and inspection sign-off.

END OF SECTION

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