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SECTION 20 05 00 - MECHANICAL AND PLUMBING GENERAL REQUIREMENTS

1.01 WORK INCLUDED
- A. THE WORK INCLUDED BY THIS DIVISION OF THE SPECIFICATIONS INCLUDES FURNISHING ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICES, INCLUDING MINOR ITEMS OMITTED BUT NECESSARY TO CONSTRUCT AND INSTALL THE COMPLETE SYSTEMS DESCRIBED BY THE CONTRACT DOCUMENTS AND SPECIFIED BELOW. "CONTRACTOR" REFERS TO THE MECHANICAL/PLUMBING CONTRACTOR. THE GENERAL CONDITIONS OF THE SPECIFICATIONS APPLY AND ARE INCLUDED IN THIS PART OF THIS SECTION.

1.02 CODES AND REGULATIONS
- A. COMPLY WITH STATE AND LOCAL CODES, AND UTILITY COMPANY REGULATIONS. FINAL INTERPRETATIONS WILL BE MADE BY THE LOCAL INSPECTION AUTHORITY. THE CONTRACTOR TO VERIFY THE GOVERNANCE OF THE FOLLOWING CODES, INCLUDING ANY LOCAL AMENDMENTS AND SUPPLEMENTARY CODES SUCH AS THE CODES OF THE NATIONAL FIRE PROTECTION ASSOCIATION:
  1. BUILDING CODE: 2021 MICHIGAN BUILDING CODE
  2. PLUMBING CODE: 2021 MICHIGAN PLUMBING CODE
  3. MECHANICAL CODE: 2021 MICHIGAN MECHANICAL CODE
  4. FIRE CODE: 2021 INTERNATIONAL FIRE CODE
  5. GAS CODE: 2020 INTERNATIONAL FUEL GAS CODE
  6. ENERGY CODE: 2021 INTERNATIONAL ENERGY CONSERVATION CODE/ ASHRAE 90.1-2019
  7. ELECTRICAL CODE: 2023 MICHIGAN ELECTRICAL CODE

1.03 QUALITY ASSURANCE
- A. PERFORM WORK TO AVOID INTERFERENCE WITH THE WORK OF OTHER TRADES. REMOVE AND RELOCATE WORK WHICH IN THE OPINION OF THE OWNER'S REPRESENTATIVES CAUSES INTERFERENCE
- B. EQUIPMENT AND MATERIALS SHALL BE NEW, UL-LISTED FOR THE USE INTENDED, AND FREE FROM DAMAGE OR DEFECT. THEY SHALL COMPLY WITH THE LATEST INDUSTRY STANDARDS.
- C. PACKAGED EQUIPMENT SHALL BEAR ALL LABELS BY RECOGNIZED NATIONAL TESTING LABORATORY.
- D. PERFORM ALL TESTS AND INSPECTIONS REQUIRED BY AUTHORITIES HAVING JURISDICTION.
- E. ALL EQUIPMENT OR COMPONENTS OF THIS SPECIFICATION SECTION SHALL MEET OR EXCEED THE REQUIREMENTS AND QUALITY OF THE ITEMS HEREIN SPECIFIED, OR AS DENOTED ON THE DRAWINGS.

1.04 CONTRACT DRAWINGS
- A. ILLUSTRATE THE GENERAL DESIGN AND EXTENT OF PERFORMANCE REQUIRED. ALL DIMENSIONS AND LOCATIONS SHALL BE TAKEN FROM THE ARCHITECTURAL DRAWINGS. CONSULT WITH ARCHITECTURAL PLANS AND LOCATE ALL CEILING EQUIPMENT WHERE INDICATED ON REFLECTED CEILING PLANS.
- B. DEVIATIONS FROM THE DRAWINGS, WITH THE EXCEPTION OF MINOR CHANGES IN ROUTING AND OTHER SUCH INCIDENTAL CHANGES THAT DO NOT AFFECT THE FUNCTIONING OR SERVICEABILITY OF THE SYSTEMS, SHALL NOT BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT/ENGINEER.
- C. THE ARCHITECTURAL AND STRUCTURAL DRAWINGS TAKE PRECEDENCE IN ALL MATTERS PERTAINING TO THE BUILDING STRUCTURE, MECHANICAL DRAWINGS IN ALL MATTERS PERTAINING TO MECHANICAL TRADES AND ELECTRICAL DRAWINGS IN ALL MATTERS PERTAINING TO ELECTRICAL TRADES. WHERE THERE ARE CONFLICTS OR DIFFERENCES BETWEEN THE DRAWINGS FOR THE VARIOUS TRADES, REPORT SUCH CONFLICTS OR DIFFERENCES TO THE ARCHITECT/ENGINEER FOR RESOLUTION.
- D. DRAWINGS ARE NOT INTENDED TO SERVE AS SHOP DRAWINGS. TAKE ALL FIELD MEASUREMENTS REQUIRED TO COMPLETE THE WORK.

1.05 SHOP DRAWINGS
- A. SUBMIT PROJECT SPECIFIC SUBMITTALS FOR REVIEW IN COMPLIANCE WITH DIVISION 01.
- B. PREPARE SHOP DRAWINGS TO SCALE FOR THE ARCHITECT/ENGINEER FOR REVIEW. EQUIPMENT AND MATERIAL SUBMITTALS REQUIRED ARE INDICATED IN THE MECHANICAL; FIRE SUPPRESSION; PLUMBING; AND HEATING, VENTILATING AND AIR CONDITIONING SECTIONS.
- C. ALL SUBMITTALS SHALL BE SUBMITTED IN GROUPINGS OF SIMILAR AND/OR RELATED ITEMS.
- D. SHOP DRAWINGS SHALL BE REVIEWED BY THE MECHANICAL CONTRACTOR FOR COMPLETENESS AND ACCURACY PRIOR TO SUBMITTING TO THE ARCHITECT/ENGINEER FOR REVIEW. THE SHOP DRAWINGS SHALL BE DATED AND SIGNED BY THE MECHANICAL CONTRACTOR PRIOR TO SUBMISSION.
- E. SUBMITTALS MUST BE JOB SPECIFIC AND NOT GENERIC IN NATURE.
- F. NO EQUIPMENT SHALL BE SHIPPED FROM STOCK OR FABRICATED UNTIL SHOP DRAWINGS FOR THEM HAVE BEEN REVIEWED BY THE ARCHITECT/ENGINEER.
- G. BY THE REVIEW OF SHOP DRAWINGS, THE ARCHITECT/ENGINEER DOES NOT ASSUME RESPONSIBILITY FOR ACTUAL DIMENSIONS OR FOR THE FIT OF COMPLETED WORK IN POSITION, NOR DOES SUCH REVIEW RELIEVE MECHANICAL TRADES OF FULL RESPONSIBILITY FOR THE PROPER AND CORRECT EXECUTION OF THE WORK REQUIRED.
- H. CONTRACTOR IS RESPONSIBLE FOR:
  - a. DIMENSIONS, WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE.
  - b. FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION.
  - c. QUANTITIES.
  - d. COORDINATION OF CONTRACTOR'S WORK WITH ALL OTHER TRADES.
  - e. SATISFACTORY PERFORMANCE OF CONTRACTOR'S WORK.
  - f. TEMPORARY ASPECTS OF THE CONSTRUCTION PROCESS.
  - g. SUBMIT DETAILED SHOP DRAWINGS OF PIPING SYSTEMS SHOWING PIPE ROUTING AND TYPES AND LOCATIONS OF ALL PIPE HANGERS.
- I. IF DEVIATIONS (NOT SUBSTITUTIONS) FROM CONTRACT DOCUMENTS ARE DEEMED NECESSARY BY THE CONTRACTOR, DETAILS OF SUCH DEVIATIONS, INCLUDING CHANGES IN RELATED PORTIONS OF THE PROJECT AND THE REASONS THEREFORE, SHALL BE SUBMITTED WITH THE SUBMITTAL FOR APPROVAL.
- J. MANUFACTURERS NOT LISTED MAY SUBMIT FOR ACCEPTANCE AS AN "APPROVED EQUAL." REQUESTS FOR AN "EQUIVALENT" MEANS "APPROVED EQUIVALENT". FOUR COPIES OF SUCH SUBMITTAL MUST BE RECEIVED BY THE ENGINEER SEVEN (7) WORKING DAYS PRIOR TO BID DATE.
  - a. THE TERMS "APPROVED", "APPROVED EQUAL", AND "EQUAL" REFER TO APPROVAL BY THE ARCHITECT OR ENGINEER AS AN ACCEPTABLE ALTERNATE BID. NO SUBSTITUTIONS WILL BE CONSIDERED THAT ARE NOT BID AS AN ALTERNATE. NO MATERIAL SUBSTITUTIONS SHALL BE CONSIDERED FOR APPROVAL PRIOR TO AWARD OF CONTRACT.
  - b. COORDINATE AND VERIFY WITH OTHER TRADES WHETHER OR NOT THE SUBSTITUTED EQUIPMENT CAN BE INSTALLED AS SHOWN ON THE CONSTRUCTION DRAWINGS WITHOUT MODIFICATION TO ASSOCIATED SYSTEMS OR ARCHITECTURAL OR ENGINEERING DESIGN. INCLUDE ADDITIONAL COSTS FOR ARCHITECTURAL AND ENGINEERING DESIGN FEES IN BID IF DRAWING MODIFICATIONS ARE REQUIRED BECAUSE OF SUBSTITUTED EQUIPMENT.

1.06 WARRANTY
- A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESSFUL OPERATION OF MECHANICAL SYSTEMS, EQUIPMENT, AND MATERIALS INSTALLED UNDER THIS CONTRACT FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE UNLESS SPECIFIC ITEMS ARE NOTED TO CARRY A LONGER WARRANTY IN THE CONSTRUCTION DOCUMENTS OR MANUFACTURER'S STANDARD WARRANTY EXCEEDS ONE YEAR . WARRANT EACH SYSTEM AND EACH ELEMENT THEREOF AGAINST ALL DEFECTS DUE TO FAULTY WORKMANSHIP, DESIGN OR MATERIAL. DEFECTIVE EQUIPMENT OR MATERIALS SHALL BE REPAIRED OR REPLACED AT NO EXPENSE TO THE OWNER. PROVIDE FOUR COMPLETE SERVICE AND MAINTENANCE CALLS SPACED AT EQUAL INTERVALS DURING THE WARRANTY PERIOD.
- B. WARRANTIES SHALL INCLUDE LABOR AND MATERIAL. MAKE REPAIRS OR REPLACEMENTS WITHOUT ANY ADDITIONAL COSTS TO THE OWNER.
- C. AT THE TIME OF FINAL ACCEPTANCE, DELIVER TO THE OWNER ALL WARRANTIES, IN WRITING AND PROPERLY EXECUTED, INCLUDING TERM LIMITS FOR WARRANTIES EXTENDING BEYOND THE ONE YEAR PERIOD, EACH WARRANTY INSTRUMENT BEING ADDRESSED TO THE OWNER AND STATING THE COMMENCEMENT DATE AND TERM.

1.07 DELIVERY, PRODUCT HANDLING, AND CLEAN UP
- A. DELIVER MATERIALS TO THE SITE IN SUCH A MATTER AS TO PROTECT THE MATERIALS FROM SHIPPING AND HANDLING DAMAGE. PROVIDE MATERIALS ON FACTORY PROVIDED SHIPPING SKIDS AND LIFTING LUGS IF REQUIRED FOR HANDLING. MATERIALS DAMAGED BY THE ELEMENTS SHOULD BE PACKAGED IN SUCH A MATTER THAT THEY COULD WITHSTAND SHORT-TERM EXPOSURE TO THE ELEMENTS DURING TRANSPORTATION.
- B. STORE MATERIALS IN CLEAN, UNDAMAGED, DRY PLACE AND PROTECT FROM WEATHER AND CONSTRUCTION TRAFFIC. HANDLE CAREFULLY TO AVOID DAMAGE. THE GENERAL CONDITIONS TAKE PRECEDENCE.
- C. USE ALL MEANS NECESSARY TO PROTECT EQUIPMENT BEFORE, DURING, AND AFTER INSTALLATION.
- D. ALL SCRATCHED, DENTED, AND OTHERWISE DAMAGED UNITS SHALL BE REPAIRED OR REPLACED AS DIRECTED BY THE ARCHITECT/ENGINEER.
- E. KEEP JOBSITE CLEAN AND TIDY ALLOWING OTHER TRADES TO CONTINUE WORK.

1.08 OPERATING AND MAINTENANCE DATA
- A. PROVIDE THE OWNER WITH OPERATING AND MAINTENANCE INSTRUCTIONS (FOUR COPIES) REQUIRED FOR OPERATION OF ALL MECHANICAL SYSTEMS. BIND THE WRITTEN INSTRUCTIONS IN A NOTEBOOK. THE GENERAL CONDITIONS TAKE PRECEDENCE. THE MANUALS SHALL INCLUDE THE FOLLOWING ITEMS:
  1. OPERATING MANUAL AND SPARE PARTS LIST FOR EACH PIECE OF EQUIPMENT.
  2. PREVENTIVE MAINTENANCE SCHEDULE FOR LUBRICATING AND CHECKING EACH PIECE OF EQUIPMENT.
  3. INSTRUCTIONS ON WHO TO CALL FOR SERVICE DURING THE WARRANTY PERIOD.

1.09 PERMITS
- A. THE CONTRACTOR SHALL PAY FOR ALL FEES, TAXES, SECURE PERMITS, LICENSES, AND INSPECTIONS REQUIRED FOR THE PROJECT.
- B. RULES OF LOCAL UTILITY COMPANIES SHALL BE COMPLIED WITH. CHECK WITH EACH UTILITY COMPANY SUPPLYING SERVICE TO THE INSTALLATION AND DETERMINE ALL DEVICES INCLUDING, BUT NOT LIMITED TO, ALL VALVES, METER BOXES, AND METERS WHICH WILL BE REQUIRED AND INCLUDE THE COST OF ALL SUCH ITEMS IN PROPOSAL.

1.10 TEMPORARY SERVICES
- A. PROVIDE TEMPORARY WATER SERVICE FOR CONSTRUCTION, AS REQUIRED BY THE GENERAL CONTRACTOR.

1.11 COORDINATION
- A. COORDINATE OUTLET DEVICE AND EQUIPMENT LOCATIONS WITH THE ARCHITECTURAL PLANS AND WORK OF OTHER TRADES. LOCATE ON HORIZONTAL AND VERTICAL LINES TO AVOID INTERFERENCE AND TO PROVIDE FUNCTIONAL USE OF ALL EQUIPMENT. VERIFY ELECTRICAL POWER CHARACTERISTICS BEFORE ORDERING EQUIPMENT.
- B. THE GENERAL GUIDELINE FOR THE DIVISION BETWEEN CONTROL (BY MC) WIRING AND POWER WIRING (BY EC) IS THAT POWER WIRING CARRIES THE CURRENT WHICH ENERGIZES A MOTOR, CONTROL WIRING DOES NOT. CONTROL WIRING MAY BE 120V, WHICH WOULD BE THE RESPONSIBILITY OF THE MC. CONTROL MOTORS ARE WIRED BY THE MC.
- C. FURNISH WIRING DIAGRAMS TO THE ELECTRICAL CONTRACTOR AS REQUIRED FOR PROPER EQUIPMENT HOOKUP. COORDINATE WITH THE ELECTRICAL CONTRACTOR THE ACTUAL WIRE SIZING AMPS FOR MECHANICAL EQUIPMENT (FROM THE EQUIPMENT NAMEPLATE) TO ENSURE PROPER INSTALLATION.
- D. EXAMINE THE SITE AND BECOME AWARE OF EXISTING CONDITIONS, UTILITIES, AND OTHER ISSUES AFFECTING THE SATISFACTORY COMPLETION OF THE PROJECT.
- E. ELECTRICAL WORK PERFORMED BY THIS CONTRACTOR WILL CONFORM TO THE STANDARDS OF DIVISION 26-28. MECHANICAL EQUIPMENT MOTORS AND CONTROLS SHALL BE FURNISHED, SET IN PLACE, AND WIRED ACCORDING WITH THE FOLLOWING SCHEDULE UNLESS OTHERWISE NOTED OR SPECIFIED. MC = DIVISION 21-23 EC = DIVISION 26-28

ITEM	FURN BY	SET BY	POWER WIRING	CONTROL WIRING
COMBINATION STARTERS	MC	EC	EC	MC
EQUIPMENT MOTORS	MC	MC	EC	--
MOTOR STARTERS & O.L. RELAYS	MC	EC	EC	MC
DISCONNECT SWITCHES	EC	EC	EC	MC
THERMAL OVERLOAD HEATERS (1)	EC	EC	EC	--
VARIABLE SPEED DRIVES	MC	EC	EC	MC
CONTROL RELAYS/TRANSFORMERS	MC	MC	EC	MC
TEMPERATURE CONTROL PANELS	MC	MC	EC	MC
TEMP. CONTROLS CONDUIT/WIRING	MC	MC	--	MC
ACTUATOR AND SOLENOID WIRING	MC	MC	--	MC
PUSHBUTTONS & PILOT LIGHTS	MC	MC	--	MC
ROOM THERMOSTATS	MC	MC	--	MC
THERMOSTATS: LINE VOLTAGE	EC	EC	EC	--

1.12 ELECTRICAL
- A. LUGS: LUGS FOR WIRING CONNECTIONS SHALL BE RATED FOR COPPER AND ALUMINUM, NAD SHALL HAVE A MINIMUM RATING OF 75C.
- B. ELECTRIC MOTORS SHALL BE RATED FOR THE APPROPRIATE APPLICATION: WET LOCATION (TEFC); SUBMERSIBLE; EXPLOSION PROOF, VFD'S, ETC.
- C. ALL LOW VOLTAGE CONTROL WIRING (24 -VOLT) SHALL BE IN CONDUIT AND IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND ALL STATE AND LOCAL CODES AND ORDINANCES AND SHALL BE DONE BY THIS HVAC CONTRACTOR.

1.13 DELIVERY, STORAGE, HANDLING
- A. PROVIDE NECESSARY HAULING AND HOISTING EQUIPMENT. PROTECT THE MATERIALS OF THIS DIVISION BEFORE, DURING, AND AFTER INSTALLATION.

1.14 AS-BUILT DRAWINGS
- A. KEEP A CURRENT SET OF "AS-BUILT" DRAWINGS ON SITE. UPON COMPLETION OF THE WORK, FURNISH ENGINEER WITH A REPRODUCIBLE PRINTS SHOWING THE "AS-BUILT" INSTALLATION.

1.15 PROJECT/SITE CONDITIONS
- A. VISIT THE SITE, EXAMINE AND VERIFY THE CONDITIONS UNDER WHICH THE WORK MUST BE CONDUCTED BEFORE SUBMITTING PROPOSAL. THE SUBMITTING OF A PROPOSAL IMPLIES THAT THE CONTRACTOR HAS VISITED THE SITE AND UNDERSTANDS THE CONDITIONS UNDER WHICH THE WORK MUST BE CONDUCTED. NO ADDITIONAL CHARGES OR TIME EXTENSIONS WILL BE ALLOWED BECAUSE OF FAILURE TO MAKE THIS EXAMINATION OR TO INCLUDE ALL MATERIALS AND LABOR TO COMPLETE THE WORK.

1.16 PLAN VERIFICATION
- A. AFTER COMPLETION OF THE BIDDING AND SELECTION PROCESS, PRIOR TO AWARDING THE CONTRACT, THE CONTRACTOR MUST REVIEW AND VERIFY THE CONTRACT DOCUMENTS IN THEIR ENTIRETY, INCLUDING THOSE OF OTHER TRADES. AT THIS TIME, DISCREPANCIES, CONFLICTS, OMISSIONS, ETC IN THE CONTRACT DOCUMENTS MUST BE DOCUMENTED. ALTERATIONS TO THE CONTRACT WILL BE MADE AT THAT TIME TO INCLUDE SUCH ITEMS, AS WELL OTHER MODIFICATIONS WHICH MIGHT BE MADE BY THE OWNER. AFTER AWARD OF THE CONTRACT, CHANGE ORDERS CAUSED BY DISCREPANCIES, CONFLICTS, OMISSIONS IN THE CONTRACT DOCUMENTS WILL NOT BE ALLOWED.

1.17 INSTRUCTION OF OWNER PERSONNEL
- A. AT A TIME MUTUALLY AGREED UPON BETWEEN THE OWNER AND CONTRACTOR, PROVIDE THE SERVICES OF A FACTORY TRAINED AND AUTHORIZED REPRESENTATIVE TO TRAIN OWNER'S DESIGNATED PERSONNEL ON THE OPERATION AND MAINTENANCE OF THE EQUIPMENT PROVIDED FOR THIS PROJECT. PROVIDE TRAINING TO INCLUDE, BUT NOT BE LIMITED TO, AN OVERVIEW OF THE SYSTEM AND/OR EQUIPMENT AS IT RELATES TO THE FACILITY AS A WHOLE, OPERATION AND MAINTENANCE PROCEDURES AND SCHEDULES RELATED TO STARTUP AND SHUTDOWN, TROUBLESHOOTING, SERVICING, PREVENTIVE MAINTENANCE AND APPROPRIATE OPERATOR INTERVENTION; AND REVIEW OF DATA INCLUDED IN THE OPERATION AND MAINTENANCE MANUALS.
- B. SUBMIT A CERTIFICATION LETTER TO THE ARCHITECT STATING THAT THE OWNER'S DESIGNATED REPRESENTATIVE HAS BEEN TRAINED AS SPECIFIED HEREIN. LETTER SHALL INCLUDE DATE, TIME, ATTENDEES AND SUBJECT OF TRAINING. THE CONTRACTOR AND THE OWNER'S REPRESENTATIVE SHALL SIGN THE CERTIFICATION LETTER INDICATING AGREEMENT THAT THE TRAINING HAS BEEN PROVIDED.
- C. SCHEDULE OWNER TRAINING WITHIN AT LEAST 7 DAYS ADVANCE NOTICE.
- D. PROVIDE TWO (2) COMPLETE SETS OF OPERATING AND MAINTENANCE INSTRUCTION BOOKLETS.

1.18 HVAC USE DURING CONSTRUCTION
- A. HVAC EQUIPMENT SHALL NOT BE USED DURING CONSTRUCTION AS A MEANS TO HEAT OR COOL THE SPACE, UNLESS SPECIFIC APPROVAL IS GIVEN BY THE OWNER. IF SUCH EQUIPMENT IS USED, IT MUST BE COMPLETELY CLEANED AND REPAIRED AS NECESSARY. CLEANING INVOLVES REPLACING ALL FILTERS; CLEANING ALL COILS AND HEAT EXCHANGERS; INSPECTING FANS, PLENUMS, AND DUCTWORK AND CLEANING AS DIRECTED BY THE OWNER.
- B. IF HVAC EQUIPMENT IS USED DURING THE CONSTRUCTION PERIOD, THIS CONTRACTOR SHALL PROVIDE MINIMUM MERV-8 FILTERS OR FILTRATION MEDIA OVER ANY RETURN AIR GRILLES AND OPEN RETURN AIR DUCT WORK FOR THE DURATION OF THE CONSTRUCTION PERIOD. CONTRACTOR SHALL PROVIDE ONE SET OF FILTERS WHEN THE UNIT IS STARTED AND REPLACE FILTERS AS NEEDED, BUT NOT LESS THAN EVERY FOUR WEEKS.
- C. ON THE DAY OF SUBSTANTIAL COMPLETION, THE CONTRACTOR SHALL CLEAN THE UNIT AND PROVIDE A NEW SET OF FILTERS IN THE UNIT.

1.19 REFRIGERANT AND OIL
- A. PROVIDE FULL REFRIGERANT AND OIL CHARGE IN NEW AIR CONDITIONING REFRIGERATION SYSTEMS, AND MAINTAIN IT FOR FULL TERM OF THE GUARANTEE.
- B. ALL NEW MECHANICAL EQUIPMENT SHALL UTILIZE R-410A.
- C. DISPOSE OF RECOVERED REFRIGERANT LEGALLY, IN ACCORDANCE WITH APPLICABLE RULES AND REGULATIONS.

2.07 MATERIALS AND EQUIPMENT
- A. PROVIDE NECESSARY EQUIPMENT, PIPING, DUCTWORK, AND ACCESSORIES THAT ARE NOT PROVIDED BY THE EQUIPMENT SUPPLIER OR OWNER TO COMPLETE INSTALLATION OF EQUIPMENT FURNISHED BY OTHERS/ EXISTING EQUIPMENT IN LOCATIONS AS INDICATED ON THE DRAWINGS AND/OR DESCRIBED IN THE GENERAL NOTES TO THIS CONTRACTOR. EQUIPMENT AND ACCESSORIES NOT PROVIDED BY THE EQUIPMENT SUPPLIER MAY INCLUDE CONDENSATE DRAINS, FLUES, VENTS, INTAKES, ASSOCIATED ROOF JACKS AND CAPS TO EXTERIOR, DAMPERS, INLINE FANS, ROOF FANS, CONTROL INTERLOCKS, ETC. AS REQUIRED FOR PROPER OPERATION OF THE COMPLETE SYSTEM IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- B. CONTRACTOR SHALL BE RESPONSIBLE FOR CORRECT ROUGH-IN DIMENSIONS AND SHALL VERIFY SAME WITH ARCHITECT AND/OR EQUIPMENT SUPPLIER PRIOR TO SERVICE INSTALLATIONS.
- C. IF AN APPROVED MANUFACTURER IS OTHER THAN THE MANUFACTURER USED AS THE BASIS FOR DESIGN, THE EQUIPMENT OR PRODUCT PROVIDED SHALL BE EQUAL IN SIZE, QUALITY, DURABILITY, APPEARANCE, CAPACITY, AND EFFICIENCY THROUGH ALL RANGES OF OPERATION, SHALL CONFORM WITH ARRANGEMENTS AND SPACE LIMITATIONS OF THE EQUIPMENT SHOWN ON THE PLANS AND/OR SPECIFIED, SHALL BE COMPATIBLE WITH THE OTHER COMPONENTS OF THE SYSTEM AND SHALL COMPLY WITH THE REQUIREMENTS FOR ITEMS REQUIRING PRIOR APPROVAL SPECIFIED IN THIS SECTION OF THE SPECIFICATIONS. ALL COSTS TO MAKE THESE ITEMS OF EQUIPMENT COMPLY WITH THESE REQUIREMENTS INCLUDING, BUT NOT LIMITED TO, PIPING, SHEET METAL, ELECTRICAL WORK, AND BUILDING ALTERATIONS SHALL BE INCLUDED IN THE ORIGINAL BID.
- D. CHANGES INVOLVING ELECTRICAL WORK: THE DESIGN OF THE MECHANICAL SYSTEMS IS BASED ON THE EQUIPMENT SCHEDULED ON THE DRAWINGS. EQUIPMENT OF HIGHER ELECTRICAL CHARACTERISTICS MAY BE FURNISHED PROVIDED SUCH PROPOSED EQUIPMENT IS APPROVED IN WRITING AND CONNECTING ELECTRICAL SERVICES, CIRCUIT BREAKERS, AND CONDUIT SIZES ARE APPROPRIATELY MODIFIED WITH NO ADDITIONAL COST TO PROJECT. IF MINIMUM ENERGY RATINGS OR EFFICIENCIES ARE SPECIFIED, EQUIPMENT SHALL COMPLY WITH REQUIREMENTS.
  - a. WHERE EQUIPMENT CHANGES ARE MADE THAT INVOLVE ADDITIONAL ELECTRICAL WORK (LARGER SIZE MOTOR, ADDITIONAL WIRING OF EQUIPMENT, ETC.) THE MECHANICAL TRADES INVOLVED SHALL COMPENSATE THE ELECTRICAL TRADES FOR THE COST OF THE ADDITIONAL WORK REQUIRED.

SECTION 20 05 10 - MECHANICAL AND PLUMBING BASIC MATERIALS AND METHODS

1.01 GENERAL
- A. COMPLY WITH REQUIREMENTS IN PUBLIC LAW 111-380, "REDUCTION OF LEAD IN DRINKING WATER ACT," ABOUT LEAD CONTENT IN MATERIALS THAT WILL BE IN CONTACT WITH POTABLE WATER FOR HUMAN CONSUMPTION.
- B. COMPLY WITH NSF 14, "PLASTICS PIPING SYSTEM COMPONENTS AND RELATED MATERIALS," FOR PLASTIC, POTABLE DOMESTIC WATER PIPING AND COMPONENTS. INCLUDE MARKING "NSF-PW" ON PIPING.
- C. COMPLY WITH NSF 61, "DRINKING WATER SYSTEM COMPONENTS - HEALTH EFFECTS; SECTIONS 1 THROUGH 9," FOR POTABLE DOMESTIC WATER PIPING AND COMPONENTS.
- D. COMPLY WITH NSF 372, "DRINKING WATER SYSTEM COMPONENTS – LEAD CONTENT" FOR POTABLE DOMESTIC WATER PIPING AND COMPONENTS.
- E. STEEL SUPPORT WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO AWS D1.1, "STRUCTURAL WELDING CODE--STEEL."
- F. STEEL PIPE WELDING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, "WELDING AND BRAZING QUALIFICATIONS." COMPLY WITH PROVISIONS IN ASME B31 SERIES, "CODE FOR PRESSURE PIPING." CERTIFY THAT EACH WELDER HAS PASSED AWS QUALIFICATION TESTS FOR WELDING PROCESSES INVOLVED AND THAT CERTIFICATION IS CURRENT.
- G. BRAZING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO ASME BOILER AND PRESSURE VESSEL CODE: SECTION IX, "WELDING AND BRAZING QUALIFICATIONS," OR AWS B2.2, "STANDARD FOR BRAZING PROCEDURE AND PERFORMANCE QUALIFICATION."
- H. SOLDERING: QUALIFY PROCESSES AND OPERATORS ACCORDING TO AWS B2.3/2.3M, "SPECIFICATION FOR SOLDERING PROCEDURE AND PERFORMANCE QUALIFICATION."

2.01 JOINING MATERIALS
- A. UNIONS: PIPE SIZE 2 INCHES AND SMALLER:
  - a. FERROUS PIPE: MALLEABLE IRON GROUND JOINT TYPE UNIONS.
  - b. UNIONS IN GALVANIZED PIPING SYSTEM SHALL BE GALVANIZED.
  - c. COPPER TUBE AND PIPE: BRONZE UNIONS WITH SOLDERED JOINTS.
- B. FLANGES: PIPE SIZES 2-1/2 INCH AND LARGER:
  - a. FERROUS PIPE: STANDARD WEIGHT, FORGED STEEL WELD NECK FLANGES.
  - b. COPPER TUBE AND PIPE: SLIP-ON BRONZE FLANGES.
  - c. PIPE-FLANGE GASKET MATERIALS: SUITABLE FOR CHEMICAL AND THERMAL CONDITIONS OF PIPING SYSTEM CONTENTS.
- C. DIELECTRIC CONNECTONS: UNION WITH GALVANIZED OR PLATED STEEL THREADED END, COPPER SOLDER END, WATER IMPERVIOUS ISOLATON BARRIER. PROVIDE NON-CONDUCTNG DIELECTRIC CONNECTONS WHEREVER JOINTNG DISSIMILAR METALS.
- D. FLANGE BOLTS AND NUTS: ASME B18.2.1, CARBON STEEL, UNLESS OTHERWISE INDICATED. SQUARE HEAD BOLTS AND NUTS ARE NOT ACCEPTABLE.
- E. SOLDER FILLER METALS: ASTM B 32, LEAD-FREE, ANTIMONY-FREE, SILVER-BEARING ALLOYS. INCLUDE WATER-FLUSHABLE FLUX ACCORDING TO ASTM B 813.
- F. BRAZING FILLER METALS: ALLOYS MEETING AWS A5.8.
  - a. USE TYPE BCUP SERIES, SILVER-BEARING, COPPER-PHOSPHORUS ALLOYS FOR JOINING COPPER OR BRONZE SOCKET FITTINGS WITH COPPER PIPE. FLUX IS PROHIBITED UNLESS USED WITH BRONZE FITTINGS.
  - b. USE TYPE BAG SERIES, CADMIUM-FREE SILVER ALLOYS FOR JOINING COPPER WITH STEEL, STAINLESS STEEL, OR OTHER FERROUS ALLOYS.
- G. WELDING FILLER METALS: COMPLY WITH AWS D10.12/D10.12M FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND CHEMICAL ANALYSIS OF STEEL PIPE BEING WELDED.
- H. WELDING MATERIALS: COMPLY WITH SECTION II, PART C, OF ASME BOILER AND PRESSURE VESSEL CODE FOR WELDING MATERIALS APPROPRIATE FOR WALL THICKNESS AND FOR CHEMICAL ANALYSIS OF PIPE BEING WELDED.
- I. SOLVENT CEMENTS FOR JOINING PVC PIPING: ASTM D 2564. INCLUDE PRIMER ACCORDING TO ASTM F 656.
- J. SOLVENT CEMENTS FOR JOINING CPVC PIPING AND TUBING: ASTM F 493.
- K. SOLVENT CEMENTS FOR JOINING ABS PIPING: ASTM D 2235.
- L. SOLVENT CEMENTS FOR JOINING PVC TO ABS PIPING TRANSITION: ASTM D 3138.
- M. PIPE THREAD COMPOUND FOR NATURAL GAS: USE TETRAFLUOROETHYLENE (TEFLON) TAPE 2 TO 3 MILS THICK
- N. PIPE THREAD COMPOUNG FOR STEEL PIPEL INORGANIC ZINC-RICH COATINGS OR CORROSION INHIBITED PROPRIETARY COMPOUND.

2.02 MOTORS AND STARTERS
- A. PROVIDE MOTORS AND STARTING EQUIPMENT WHERE NOT FURNISHED WITH THE EQUIPMENT PACKAGE. MOTORS SHALL HAVE COPPER WINDINGS, CLASS B INSULATION, AND STANDARD SQUIRREL CAGE WITH STARTING TORQUE CHARACTERISTICS SUITABLE FOR THE EQUIPMENT SERVED. MOTORS FOR AIR HANDLING EQUIPMENT SHALL BE SELECTED FOR QUIET OPERATION. EACH MOTOR SHALL BE CHECKED FOR PROPER ROTATION AFTER ELECTRICAL CONNECTION HAS BEEN COMPLETED. PROVIDE DRIP-PROOF ENCLOSURE FOR LOCATIONS PROTECTED FROM WEATHER AND NOT IN AIR STREAM OF FAN; AND TOTALLY ENCLOSED FAN-COOLED ENCLOSURE FOR MOTORS EXPOSED TO WEATHER. MOTORS SHALL BE MANUFACTURED BY CENTURY, GENERAL ELECTRIC, WESTINGHOUSE, LOUIS-ALLIS OR APPROVED EQUAL.
- B. PROVIDE EVERY MOTOR, EXCEPT FRACTIONAL HORSEPOWER SINGLE PHASE MOTORS WITH AN APPROVED TYPE OF BUILT-IN THERMAL OVERLOAD PROTECTION, WITH A MOTOR STARTER. EACH STARTER SHALL BE PROVIDED WITH OVERLOAD HEATERS SIZED TO THE MOTOR RATING, AND EVERY THREE-PHASE MOTOR STARTER SHALL HAVE OVERLOAD HEATERS IN EACH PHASE. AMBIENT COMPENSATED HEATERS SHALL BE INSTALLED WHEREVER NECESSARY, UNLESS NOTED OTHERWISE. MOTOR STARTERS SHALL BE FURNISHED BY THE DIVISION 26 CONTRACTOR. FOR INSTALLATION AND CONNECTION BY THE DIVISION 16 CONTRACTOR, STARTERS SHALL BE ALLEN-BRADLEY, CLARK, FURNAS, SQUARE D, OR APPROVED EQUAL.

2.03 ACCESS PANELS
- A. THE MECHANICAL CONTRACTOR SHALL FURNISH AND GENERAL CONTRACTOR SHALL INSTALL ACCESS PANELS WHERE REQUIRED FOR ACCESS TO EQUIPMENT. THE MECHANICAL CONTRACTOR SHALL INCLUDE THE COST OF INSTALLATION IN HIS BID. ACCESS PANELS SHALL BE ADEQUATELY SIZED, OF A TYPE APPROVED BY THE ARCHITECT AND SHALL BE FIRE OR SMOKE-RATED AS REQUIRED. ACCESS PANELS SHALL BE MINIMUM 18"X18".

2.04 STRUCTURAL STEEL
- A. STRUCTURAL STEEL USED FOR SUPPORT OF EQUIPMENT, DUCTWORK AND PIPING SHALL BE NEW, CLEAN AND CONFORM TO ASTM DESIGNATION A-36.
- B. SUPPORT MECHANICAL COMPONENTS FROM THE BUILDING STRUCTURE. DO NOT SUPPORT MECHANICAL COMPONENTS FROM CEILINGS, OTHER MECHANICAL OR ELECTRICAL COMPONENTS, NOR OTHER NON-STRUCTURAL ELEMENTS.

2.05 PENETRATIONS AND SLEEVES
- A. SLEEVE-SEAL SYSTEMS SHALL INCLUDE MODULAR SEALING-ELEMENT DESIGNED FOR FIELD ASSEMBLY FOR FILLING AN ANNULAR SPACE BETWEEN PIPE AND SLEEVE. SEAL SHALL BE DESIGNED FOR HYDROSTATIC PRESSURE OF 20 PSIG. SEAL SHALL BE MADE OF EPDM-RUBBER WITH INTERLOCKING LINKS SHAPED TO FIT SURFACE OF PIPE. PRESSURE PLATES SHALL BE MADE OF STAINLESS STEEL WITH STAINLESS STEEL CONNECTING BOLTS AND NUTS. APPROVED MANUFACTURE ARE METRAFLEX, CALPICO, PIPELINE SEAL AND INSULATOR.
- B. PIPE SLEEVES SHALL BE STEEL PIPE IN ACCORDANCE WITH ASTM A 53, TYPE E, GRADE B, SCHEDULE 40 WITH PLAIN ENDS AND INTEGRAL WELDED WATERSTOP COLLAR.
- C. SEAL ELEVATED FLOOR, EXTERIOR WALL AND ROOF PENETRATIONS WATERTIGHT AND WEATHERTIGHT WITH NON- SHRINK, NON-HARDENING COMMERCIAL SEALANT. PACK WITH MINERAL WOOL AND SEAL BOTH ENDS WITH MINIMUM OF 1/2" OF SEALANT. SEAL AROUND PENETRATIONS OF FIRE-RATED ASSEMBLIES. COORDINATE FIRE RATINGS AND LOCATIONS WITH THE ARCHITECTURAL DRAWINGS. REFER TO STANDARD PENETRATION DETAILS.
- D. INSTALL SLEEVES IN CONCRETE FLOORS, WALLS, ROOFS AS THEY ARE CONSTRUCTED. CUT SLEEVES TO LENGTH FOR MOUNTING FLUSH. EXTEND SLEEVES IN MECHANICAL ROOM FLOORS OR AREAS PIPE IS SUBJECT TO DAMAGE 2 INCHES ABOVE FINISHED FLOOR.

2.06 FIRE STOPPING
- A. SEAL OPENINGS OF FIRE RATED CONSTRUCTION WITH A MATERIAL OR PRODUCT THAT HAS BEEN TESTED AT AN INDEPENDENT TESTING LABORATORY SUCH AS UL OR FM. FIRE STOPPING SHALL CONFORM TO ASTM E-814, UL 1479, OR UL 2079. PRODUCTS SHALL BE SIMILAR TO RECTORSEAL METACAULK, 3M BRAND FIRE BARRIER PENETRATION SEALING SYSTEMS, OR HILTI.

2.08 SPARE PARTS
- A. CONTRACTOR SHALL PROVIDE TO THE OWNER, WITH RECEIPT, THE FOLLOWING SPARE PARTS FOR THE EQUIPMENT INSTALLED FOR THIS PROJECT:
  - a. ONE SET OF SPARE FILTERS OF EACH TYPE REQUIRED FOR EACH UNIT. IN ADDITION TO THE SPARE SET OF FILTERS, INSTALL NEW FILTERS PRIOR TO TESTING, ADJUSTING AND BALANCING WORK AND BEFORE TURNING SYSTEM OVER TO OWNER.
  - b. ONE COMPLETE SET OF BELTS FOR EACH FAN.
  - c. THREE OPERATING KEYS FOR EACH TYPE OF AIR OUTLET AND INLET THAT REQUIRE THEM.

2.09 LOW EMITTING MATERIALS
- A. ALL SEALANTS & ADHESIVES REQUIRED FOR THE INSTALLATION OF MECHANICAL & PLUMBING SYSTEM WITHIN THE BUILDING ENVELOPE SHALL MEET THE REQUIREMENTS FOR LOW EMITTING MATERIALS AS SET FOR IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD) RULE #1168 (OR LEED NEW CONSTRUCTION REQUIREMENTS), WHICH INCLUDES BUT IS NOT LIMITED TO:
  - a. METAL TO METAL ADHESIVE: VOC LIMIT OF 30G/L.
  - b. FIBERGLASS ADHESIVE: VOC LIMIT OF 80G/L.
  - c. MULTIPURPOSE CONSTRUCTION ADHESIVE: VOC LIMIT OF 70 G/L.

3.01 UTILITIES AND PROTECTION OF SERVICES
- A. DO NOT INTERRUPT AND UTILITY OR SERVICE WITHOUT ADEQUATE NOTICE AND SCHEDULE. CONTRACTOR SHALL, AT OWN EXPENSE, REPAIR, REPLACE, AND MAINTAIN IN SERVICE ANY UTILITIES DAMAGED OR BROKEN OR OTHERWISE RENDERED INOPERATIVE DURING THE COURSE OF CONSTRUCTION.

3.02 PROTECTION DURING CONSTRUCTION
- A. PLUMBING FIXTURES, TRIM AND OTHER EQUIPMENT SHALL BE PROTECTED AGAINST DAMAGE OR INJURY. ALL FIXTURES AND EQUIPMENT DAMAGED BY ANY CAUSE AND ANY TRIM WITH MARRED OR SCRATCHED FINISH SHALL BE REPLACED AT NO ADDITIONAL COST TO THE OWNER. THE FIXTURE PROTECTION SHALL BE REMOVED AT THE COMPLETION OF THE WORK OR FOR FINAL INSPECTION.

3.03 EXCAVATION AND BACKFILLING
- A. PERFORM EXCAVATION AND BACKFILL REQUIRED FOR INSTALLATION OF UNDERGROUND WORK UNDER THIS CONTRACT. TRENCHES SHALL BE OF SUFFICIENT WIDTH. CRIB OR BRACE TRENCHES TO PREVENT CAVE-IN OR SETTLEMENT. DO NOT EXCAVATE TRENCHES CLOSE TO COLUMNS AND WALLS OF NEW BUILDING WITHOUT PRIOR CONSULTATION WITH THE ARCHITECT. USE PUMPING EQUIPMENT IF REQUIRED TO KEEP TRENCHES FREE OF WATER. BACKFILL TRENCHES IN MAXIMUM 6" LAYERS OF WELL-TAMPED DRY EARTH IN A MANNER TO PREVENT FUTURE SETTLEMENT.
- B. EXCAVATION AS HEREIN SPECIFIED SHALL BE UNCLASSIFIED. COMMON EXCAVATION SHALL COMPRISE THE SATISFACTORY REMOVAL AND DISPOSITION OF MATERIAL OF WHATEVER SUBSTANCES AND OF EVERY DESCRIPTION ENCOUNTERED, INCLUDING ROCK, IF ANY, WITHIN THE LIMITS OF THE WORK AS SPECIFIED AND SHOWN ON THE DRAWINGS. EXCAVATION SHALL BE PERFORMED TO THE LINES AND GRADES INDICATED ON THE DRAWINGS. EXCAVATED MATERIALS WHICH ARE CONSIDERED UNSUITABLE FOR BACKFILL, AND SURPLUS OF EXCAVATED MATERIAL WHICH IS NOT REQUIRED FOR BACKFILL, SHALL BE DISPOSED OF BY THE CONTRACTOR AT HIS OWN EXPENSE AND RESPONSIBILITY, AND TO THE SATISFACTION OF THE ARCHITECT.

3.04 CUTTING AND REPAIRING
- A. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING, DRILLING, WELDING, AND REPAIR OF WALLS, FLOORS, CEILINGS, ETC. AS REQUIRED FOR TO INSTALL WORK UNDER THIS SECTION. OBTAIN PERMISSION FROM THE ARCHITECT PRIOR TO CUTTING. DO NOT CUT OR DISTURB STRUCTURAL MEMBERS WITHOUT PRIOR APPROVAL FROM THE ARCHITECT. CUT HOLES AS SMALL AS POSSIBLE. GENERAL CONTRACTOR SHALL PATCH WALLS, FLOORS, ETC. AS REQUIRED BY WORK UNDER THIS SECTION. PATCHING SHALL MATCH THE ORIGINAL MATERIAL AND CONSTRUCTION. REPAIR AND REFINISH AREAS DISTURBED BY WORK TO THE CONDITION OF ADJOINING SURFACES IN A MANNER SATISFACTORY TO THE ARCHITECT. THE GENERAL CONDITIONS TAKE PRECEDENCE.

3.05 CONCRETE WORK
- A. NEW FLOOR MOUNTED EQUIPMENT/ FIXTURES SHALL BE CONNECTED TO THE EXISTING SANITARY DRAINAGE SYSTEM AS SHOWN ON THE DRAWINGS OR AS REQUIRED. SAW-CUT EXISTING CONCRETE FLOOR AS REQUIRED TO INSTALL NEW UNDERFLOOR PIPES, AND PATCH TO MATCH EXISTING SUB-FLOOR INCLUDING ANY WIRE MESH. REFER TO ARCHITECTURAL SPECIFICATIONS FOR FINISH FLOOR PATCHING REQUIREMENTS.
- B. CONTRACTOR SHALL PROVIDE CONCRETE EQUIPMENT BASES AS SHOWN ON PLANS.

3.06 START-UP PROCEDURES
- A. FOLLOW MANUFACTURER'S RECOMMENDED PROCEDURES IN STARTING UP THE EQUIPMENT; DAMAGE CAUSED DURING START-UP SHALL BE REPLACED AT NO EXPENSE TO THE OWNER.
- B. EQUIPMENT PROVIDER SHALL BE RESPONSIBLE FOR PROVIDING EQUIPMENT START-UP AND, WHEN NOTED, AN IN THE FIELD CERTIFIED TRAINING SESSION. NEW EQUIPMENT START-UP SHALL BE FOR THE PURPOSE OF INSPECTING EQUIPMENT INSTALLATION MANNER AND CONTROL SYSTEM START-UP. A COPY OF THE START-UP REPORT SHALL BE MADE AND SENT TO BOTH THE CONTRACTOR AND TO THE ENGINEER.

SECTION 20 05 19 - METERS AND GAUGES

2.01 THERMOMETERS
- A. 9 INCH LONG DIE-CAST ALUMINUM OR CHROME PLATED BRASS WITH GLASS WINDOW. RED, BLUE, OR GREEN INDICATORS. ADJUSTABLE CONNECTOR WITH 180 DEG VERTICAL PLANE AND 360 DEG HORIZONTAL ORIENTATION. ACCURACY SHALL BE PLUS OR MINUS 1 PERCENT. APPROVED MANUFACTURE ARE AMETEK, MILIJOCO, TRERICE, OR WEISS INSTRUMENTS.
- B. THERMOWELLS SHALL BE PRESSURE-TIGHT, SOCKET-TYPE METAL FITTING MADE FOR INSERTION INTO PIPING AND OF TYPE, DIAMETER, AND LENGTH REQUIRED TO HOLD THERMOMETER. BRASS FOR COMPATIBLE SERVICES LESS THAN 353 DEGREES F ; STAINLESS STEEL FOR ALL OTHERS TO SUIT SERVICE. FURNISH EXTENSION NECK TO ACCOMMODATE INSULATION WHERE APPLICABLE. SAME MANUFACTURER OF THERMOMETER BEING USED.

2.02 PRESSURE GAUGES
- A. PRESSURE GAUGES SHALL BE DIRECT MOUNTING, DIAL-TYPE WITH STAINLESS STEEL CASE OR ALUMINUM. PRESSURE ELEMENT SHALL BE BOURDON TUBE WITH BRASS CONNECTION. THE DIAL SHALL BE NONREFLECTIVE WITH PERMANENT SCALE MARKINGS. ACCURACY SHALL BE PLUS OR MINUS 1 PERCENT.
- B. PROVIDE VALVES, SYPHONS, AND SNUBBERS AS REQUIRED.

SECTION 20 05 29 - HANGERS AND SUPPORTS

1.01 GENERAL
- A. REFER TO DUCT AND PIPING APPLICATION SCHEDULE FOR HANGER, ROD, SPACING, AND TYPES APPROVED FOR DIFFERENT SYSTEMS AND SIZES.
- B. SUPPORT EQUIPMENT, PIPING, DUCTWORK FROM THE STRUCTURE TO PREVENT SAGGING, POCKETING, SWAYING, AND VIBRATIONS, AND ARRANGED TO PROVIDE FOR EXPANSION AND CONTRACTION. HANGERS SUPPORTING VIBRATING EQUIPMENT SHALL BE PROVIDED WITH SPRING ISOLATORS. CHAIN, PERFORATED IRON OR WIRE HANGERS ARE NOT PERMITTED. SUPPORTS SHALL BE CONNECTED TO THE BUILDING STRUCTURE ONLY. EQUIPMENT, PIPES, DUCTWORK SHALL NOT BE SUPPORTED FROM ONE ANOTHER.
- C. DUCT HANGER SPACING: COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," TABLE 5-1 (TABLE 5-1M), "RECTANGULAR DUCT HANGERS MINIMUM SIZE," AND TABLE 5-2, "MINIMUM HANGER SIZES FOR ROUND DUCT," FOR MAXIMUM HANGER SPACING; INSTALL HANGERS AND SUPPORTS WITHIN 24 INCHES OF EACH ELBOW AND WITHIN 48 INCHES OF EACH BRANCH INTERSECTION.

2.01 METAL PIPE HANGERS
- A. CARBON STEEL WITH GALVANIZED COATING, STAINLESS STEEL, AND COPPER PIPE HANGERS SHALL BE MSS SP-58 TYPES 1 THROUGH 58. COPPER HANGERS SHALL BE USED WITH COPPER PIPE. WET AND CORROSIVE ENVIRONMENTS SHALL USE STAINLESS STEEL.
- B. HANGER RODS SHALL BE CONTINUOUS THREAD WITH NUTS AND WASHERS MADE OF CARBON STEEL UNLESS LOCATED IN WET OR CORROSIVE ENVIRONMENT, WHICH SHALL BE STAINLESS STEEL. USE COPPER COATED STEEL ROD FOR COPPER PIPING.

2.02 METAL FRAMING SYSTEMS
- A. SHOP OR FIELD FABRICATED ASSEMBLY OF STEEL CHANNELS AND COMPONENTS WITH GALVANIZED COATING. PLASTIC OR JACKET IN WET OR CORROSIVE ENVIRONMENTS. APPROVED MANUFACTURES ARE ANVIL, EATON, UNISTRUT.

2.03 SHIELDS, SADDLES, AND INSERTS
- A. PROVIDE MSS SP-69 TYPE 40 METAL SHIELDS, MSS SP-69 TYPE 391 AND TYPE 39B SADDLES, AND THERMAL PIPE SHIELDS AS REQUIRED. APPROVED MANUFACTURERS ARE EATON, ERICO, PIPE SHIELDS INC.

2.04 STAINLESS STEEL LOAD RATE SUSPENSION CABLE
- A. APPROVED MANUFACTURES: DUCTMATE, DURO DYNE CORP., GRIPPLE INC.
- B. AIRPLANE QUALITY STAINLESS STEEL 7X7 AND 7X19 WIRE ROPE COMPLYING WITH ASTM A 492. ONE PIECE STAINLESS STEEL FASTENER AND LOOP ENDS, STUD END, OR PLAIN ENDS. CABLE SHALL BE USED FOR DUCTWORK ONLY.

2.05 ROOF CURBS AND SUPPORTS
- A. EQUIPMENT CURB: GALVANIZED STEEL WELDED 18-GAUGE SHELL WITH MITERED CORNERS; 1-1/2-INCH- (40-MM-) THICK, 3 POUND RIGID, FIBERGLASS INSULATION ADHERED TO INSIDE WALLS; AND 1-1/2-INCH (40-MM) WOOD NAILER. SIZE AS REQUIRED TO SUIT ROOF OPENING AND FAN BASE. SELF-FLASHING WITHOUT A CANT STRIP, WITH MOUNTING FLANGE. CURB SHALL BE 16 INCHES TALL MINIMUM.

2.06 NON-PENETRATING ROOF SUPPORTS
- A. APPROVED MANUFACTURERS: B-LINE BY EATON, ECO SUPPORT PRODUCTS, ERICO, MIRO, PORTABLE PIPE, PATE
- B. TYPES:
  - a. LOW, FIXED-HEIGHT, SINGLE-BASE STAND: ASSEMBLY OF BASE AND HORIZONTAL MEMBER, AND PIPE SUPPORT, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.
  - b. LOW, ADJUSTABLE-HEIGHT, SINGLE-BASE STAND: ASSEMBLY OF BASE, HORIZONTAL MEMBER, AND ADJUSTABLE VERTICAL MEMBERS, AND PIPE SUPPORT, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.
  - c. HIGH, ADJUSTABLE-HEIGHT, SINGLE-BASE STAND: ASSEMBLY OF BASE, HORIZONTAL MEMBER, AND ADJUSTABLE VERTICAL MEMBERS, AND CLEVIS TYPE PIPE SUPPORT, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.
  - d. LOW, FIXED-HEIGHT, SINGLE-BASE ROLLER STAND: ASSEMBLY OF BASE AND HORIZONTAL ROLLER, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.
  - e. LOW, ADJUSTABLE-HEIGHT, SINGLE-BASE ROLLER STAND: ASSEMBLY OF BASE AND HORIZONTAL ROLLER, FOR ROOF INSTALLATION WITHOUT MEMBRANE PENETRATION.
- C. BASESHALL BE PLASTIC, STAINLESS STEEL, OR RECYCLED RUBBER.
- D. HORIZONTAL MEMBER SHALL BE CADMIUM-PLATED-STEEL OR GALVANIZED-STEEL STRUT DESIGNED FOR USE WITH STANDARD STRUT CLAMPS AND ACCESSORIES.
- E. VERTICAL MEMBERS SHALL BE THREADED, HOT ROLLED, STEEL ROD CONFORMING TO ASTM A 36 OR A575 WITH CADMIUM PLATED NUTS AND WASHERS. ROD CONTINUOUSLY THREADED.

SECTION 20 05 33 - MECHANICAL IDENTIFICATION

2.01 IDENTIFICATION
- A. APPROVED MANUFACTURERS: BRADY, SETON NAMEPLATE COMPANY, EMED, BRIMAR INDUSTRIES, AND KOLBI
- B. TYPES LISTED BELOW SHALL BE IN ACCORDANCE ASME A13.1:
  1. EQUIPMENT NAMEPLATES: METAL WITH DATA STAMPED FOR PERMANENT ATTACHMENT WITH FASTENER
  2. EQUIPMENT MARKER: ENGRAVED, COLOR-CODED LAMINATED PLASTIC WITH ADHESIVE
  3. ACCESS PANEL DOOR MARKER: ENGRAVED LAMINATED PLASTIC WITH CENTER HOLE FOR FASTENER
  4. PIPE MARKER: PRE-TENSIONED SEMIRIGID PLASTIC FORMED TO COVER PIPE OR SHAPED PREFORMED SEMIRIGID PLASTIC FORMED TO PARTIALLY COVER PIPE
  5. DUCT MARKERS: ENGRAVED PLASTIC WITH ADHESIVE OR VINYL WITH ADHESIVE INCLUDE DIRECTION
  6. VALVE TAGS: STAMPED OR ENGRAVED BRASS WITH CHAIN
- C. INSTALL IDENTIFICATION ON DUCTS, PIPES, EQUIPMENT IN VISIBLE LOCATIONS IN FINISHED SPACES, SHAFTS, MACHINE ROOMS, PLENUMS, CONCEALED LOCATIONS AND ON BOTH SIDES OF PENETRATIONS.

SECTION 20 07 00 - INSULATION

1.01 GENERAL
1. REFER TO DUCT AND PIPING APPLICATION SCHEDULES FOR INSULATION MATERIAL AND THICKNESS.
2. INSULATING MATERIALS, ADHESIVES, COATINGS, ETC. SHALL NOT EXCEED FLAME SPREAD RATING OF 25 AND SMOKE DEVELOPMENT RATING OF 50 PER ASTM E 84; ADHESIVES, COATINGS, ETC. CONTAINERS FOR MASTICS AND ADHESIVES SHALL HAVE UL LABEL.
3. CONTRACTOR SHALL INSPECT THE INSULATION OF ALL EXISTING AND NEW SUPPLY AIR DUCTWORK CONNECTIONS AND REPAIR AS REQUIRED.

2.01 PIPE INSULATION
- A. FLEXIBLE ELASTOMERIC
  - a. APPROVED MANUFACTURES: ARMACELL OR IK INSULATION GROUP
  - b. INSULATION SHALL BE CLOSED-CELL, EXPANDED RUBBER MATERIAL HAVING A CONDUCTIVITY OF 0.26 AT 75 °F MEAN, IN ACCORDANCE WITH ASTM C 534.
  - c. EXTERIOR PIPING INSULATION WILL BE PAINTED WITH A WHITE SOLVENT BASED ALKYD FINISH(ARMAFLEX AB OR EQUIVALENT), INCLUDING ALL FITTINGS, VALVES, ETC. JACKET AND INSULATION WILL BE SEALED WEATHERTIGHT AND INSTALLED PER MANUFACTURERS INSTRUCTIONS. WHERE EXPOSED TO PHYSICAL DAMAGE, EXTERIOR PIPING INSULATION WILL BE COVERED WITH ALUMINUM JACKET, INCLUDING ALL FITTINGS, VALVES, ETC. JACKET AND INSULATION WILL BE SEALED WEATHERTIGHT AND INSTALLED PER MANUFACTURERS INSTRUCTIONS.
- B. GLASS-FIBER
  - a. APPROVED MANUFACTURES: JOHNS MANVILLE, KNAUF, MANSON, AND OWENS CORNING.
  - b. PREFORMED PIPE INSULATION, TYPE I, 850 DEG GLASS FIBER WITH THERMOSETTING RESIN, COMPLY ASTM C 547, GRADE A, WITH FACTORY APPLIED ALL SERVICE JACKET. CONDUCTIVITY OF 0.26 AT 75 °F MEAN.

2.02 DUCT LINER
- A. APPROVED MANUFACTURES: JOHNS MANVILLE, OWENS-CORNING, CERTAINEED OR KNAUF.
- B. DUCT LINER SHALL BE 1-1/2 LB DENSITY (3.0LB FOR EXTERIOR DUCTS), CONSTRUCTED OF GLASS FIBER LINER. THE AIR STREAM SURFACE IS COATED WITH BLACK-COATED MAT SURFACE. LINER SHALL HAVE A K-FACTOR OF .25 AT 75 °F MEAN.
- C. DUCT LINER SHALL BE INSTALLED AS FOLLOWS OR AS SHOWN ON THE PLANS:
  - a. RETURN AIR DUCTS (WITHIN 15' OF FAN)
- D. LINER SHALL BE SECURED TO ALL DUCT SURFACES BY PRESSING INTO WET ADHESIVE, APPLIED TO 100% OF THE DUCT SURFACE. IN ADDITION, LINER SHALL BE HELD IN PLACE WITH INSULPINS WELDED TO DUCT, SAME MATERIALS, AND WITH CLIPS SLIPPED OVER THE PINS. INSULPINS SHALL BE LOCATED PER SMACNA STANDARDS. LINER SHALL BE LAPPED AND COMPRESSED IN ALL FOUR CORNERS OF THE DUCT. BOTH UPSTREAM AND DOWNSTREAM TRANSVERSE EDGES SHALL BE COATED WITH ADHESIVE, COATED A MINIMUM OF 1" OVER THE EDGE IN ALL PLACES.

2.03 DUCT INSULATION
- A. FIBERGLASS
  1. APPROVED MANUFACTURERS: JOHNS MANVILLE, KNAUF, OWENS-CORNING, AND CERTAINTEED
  2. DUCT BLANKET INSULATION SHALL BE FLEXIBLE FIBERGLASS INSULATION, 1.5 PCF, WITH FACTORY-APPLIED, REINFORCED, ALUMINUM FOIL VAPOR BARRIER/JACKET. INSULATION SHALL HAVE A K-FACTOR OF .25 AT 75 °F MEAN. SHALL BE IN ACCORDANCE WITH ASTM C 553, TYPE II.
  3. DUCT BOARD INSULATION SHALL BE RIGID FIBERGLASS INSULATION, 1.5 PCF, WITH FACTORY-APPLIED, ALUMINUM FOIL VAPOR BARRIER/JACKET. INSULATION SHALL HAVE A K-FACTOR OF .25 AT 75 °F MEAN. SHALL BE IN ACCORDANCE WITH ASTM C 553.
  4. WRAP THE FIBERGLASS BLANKET WITH HEAVY DUTY FOIL SCRIM FACING AROUND THE DUCTWORK WITH OVERLAPPING FLANGES STAPLED AT 6" ON CENTER. STRIP THE LAP OF INSULATION AND STAPLE THE FACING DIRECTLY TO THE OVERLAPPED FOIL. SECURE THE INSULATION TO THE DUCTWORK WITH 18-GAUGE GALVANIZED WIRE AT 12" ON CENTER. ON DUCTS LARGER THAN 48", USE MECHANICAL FASTENERS ON THE BOTTOM OF THE DUCT.
  5. TAPE ALL JOINTS WITH 3" WIDE FOIL REINFORCED KRAFT TAPE. TAPE ALL PIN PENETRATIONS OR PUNCTURES IN THE FACING.

2.04 FIRE RATED INSULATION
- A. APPROVED MANUFACTURES: THERMAL CERAMICS, 3M FIRE PROTECTION PRODUCTS, UNIFRAX CORP.
- B. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS TESTED ACCORDING TO ASTM E2336.
- C. FIRE-RATED BLANKET: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS UL TESTED AND CERTIFIED TO PROVIDE A 2-HOUR FIRE RATING.
- D. FIRE-RATED PLENUM WRAP: HIGH-TEMPERATURE, FLEXIBLE, BLANKET INSULATION WITH FSK JACKET THAT IS UL TESTED, AND DESIGNED TO PROVIDE A SINGLE-LAYER, FLEXIBLE ENCLOSURE AROUND COMBUSTIBLE ITEMS LOCATED WITHIN FIRE-RATED RETURN AIR PLENUM.
- E. INSTALL PER MANUFACTURE REQUIREMENTS.

2.05 INSULATING SEALANTS, ADHESIVES, AND MASTICS
- A. SEALANTS
  - a. FOIL SCRIM KRAFT AND METAL JACKET FLASHING SEALANT SHALL BE FIRE AND WATER RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT WITH TEMP RANGE AND ALUMINUM COLOR. APPROVED MANUFACTURE: MARATHON INDUSTRIES, FOSTER PRODUCTS, MON-ECO INC.
  - b. ALL SERVICE JACKET FLASHING SEALANTS, PVC, PVDC, AND VINYL SEALANTS SHALL BE FIRE AND WATER RESISTANT, FLEXIBLE, ELASTOMERIC SEALANT WITH TEMP RANGE AND ALUMINUM WHITE. APPROVED MANUFACTURE: CHILDERS PRODUCTS
- B. ADHESIVES
  - a. FLEXIBLE ELASTOMERIC ADHESIVE: COMPLY WITH MIL-A-24179A, TYPE II, CLASS I. APPROVED MANUFACTURE: ARMACELL, FOSTER PRODUCTS, RBX CORP.
  - b. MINERAL-FIBER ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A. APPROVED MANUFACTURE: MARATHON INDUSTRIES, FOSTER PRODUCTS, MON-ECO INC.
  - c. ALL SERVICE JACKET ADHESIVE, AND FOIL SCRIM KRAFT AND PVDC JACKET ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A FOR BONDING INSULATION JACKET LAP SEAMS AND JOINTS. APPROVED MANUFACTURE: MARATHON INDUSTRIES, FOSTER PRODUCTS, MON-ECO INC.
- C. MASTICS
  - a. VAPOR BARRIER MASTIC SHALL COMPLY WITH ASTM E 96 WITH 0.013 PERM AND SHALL BE WHITE. APPROVED MANUFACTURE: MARATHON INDUSTRIES, FOSTER PRODUCTS, MON-ECO INC.
  - b. BREATHER MASTIC SHALL COMPLY WITH ASTM F 1249 WITH 03 PERM AND SHALL BE WHITE. APPROVED MANUFACTURE: MARATHON INDUSTRIES, FOSTER PRODUCTS, MON-ECO INC.

2.06 FACTORY APPLIED JACKETS
- A. INSULATION SYSTEMS INDICATE FACTORY-APPLIED JACKETS ON VARIOUS APPLICATIONS. WHEN FACTORY-APPLIED JACKETS ARE INDICATED, COMPLY WITH THE FOLLOWING:
  - a. ALL SERVICE JACKET WHITE, KRAFT-PAPER, FIBERGLASS-REINFORCED SCRIM WITH ALUMINUM-FOIL BACKING; COMPLYING WITH ASTM C 1136, TYPE I.
  - b. ALL SERVICE JACKET SELF SEALING LAP: ASJ WITH SELF-SEALING, PRESSURE-SENSITIVE, ACRYLIC-BASED ADHESIVE COVERED BY A REMOVABLE PROTECTIVE STRIP; COMPLYING WITH ASTM C 1136, TYPE I.
  - c. FOIL SCRIM KRAFT JACKET: ALUMINUM-FOIL, FIBERGLASS-REINFORCED SCRIM WITH KRAFT-PAPER BACKING; COMPLYING WITH ASTM C 1136, TYPE II.

2.07 FIELD APPLIED JACKETS
- A. PVC JACKETS SHALL BE HIGH IMPACT RESISTANT, UV-RESISTANT, COMPLY WITH ASTM D 1784 ROLL STOCK FOR FIELD CUTTING AND INSTALLATION. JACKET SHALL BE WHITE WITH ADHESIVE BACKING. PROVIDE ALL NECESSARY FITTING COVERS AND SHAPES. APPROVED MANUFACTURES: JOHNS MANVILLE, P.I.C. PLASTICS, PROTO PVC CORP., AND SPEEDLINE
- B. METAL JACKETS SHALL BE ALUMINUM AND COMPLY WITH ASTM B 209 3003, 3005, 3015 OR 5005 TEMPER H-14. SHALL BE ROLL STOCK READY FOR FIELD CUTTING WITH STANDARD FINISH. INDOOR/OUTDOOR APPLICATION SHALL BE HEAT BONDED POLYETHYLENE AND KRAFT PAPER 1 MIL AND 3 MIL THICK RESPECTIVELY.

2.08 TAPES
- A. ALL SERVICE JACKET TAPE SHALL BE WHITE, 3 INCHES WIDE AND 11.5 MILS THICK WITH MATCHING FACTORY APPLIED JACKET WITH ACRYLIC ADHESIVE. APPROVED MANUFACTURES: AVERY DENNISON CORP, VENTURE, COMPACT CORP.
- B. FOIL SCRIM KRAFT TAPE SHALL BE FOIL FACE, 3 INCHES WIDE AND 6.5 MILS THICK WITH MATCHING FACTORY APPLIED JACKET/VAPOR RETARDER WITH ACRYLIC ADHESIVE. APPROVED MANUFACTURES: AVERY DENNISON CORP, VENTURE, COMPAC CORP.
- C. PVC TAPE SHALL BE WHITE AND SUITABLE FOR INDOOR AND OUTDOOR APPLICATION, 2 INCHES WIDE AND 6 MILS THICK WITH MATCHING FACTORY APPLIED JACKET/VAPOR RETARDER WITH ACRYLIC ADHESIVE. APPROVED MANUFACTURES: AVERY DENNISON CORP, VENTURE, COMPAC CORP.
- D. COVER JOINTS AND ALL SEAMS WITH TAPE AS RECOMMENDED BY MANUFACTURE TO MAINTAIN VAPOR SEAL.

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LICENSED PROFESSIONAL ENGINEER

#	ISSUANCE	DATE
	PERMITS	09.12.2025

PROJECT
EVART MIXED USE
101 S Main St., Evart, MI 49631

PROJECT NO.
2025-0061

SHEET TITLE
SPECIFICATIONS

M-003

9/12/2025 11:49:44 AM
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