SECTION 00 91 11
ADDENDUM NUMBER 001

PARTICULARS

DATE: JANUARY 14, 2021

PROJECT: VETERANS VILLAGE COMMUNITY BUILDING

OWNER: CITY OF JONESBORO, ARKANSAS

ARCHITECT: COOPER MIXON ARCHITECTS, PLLC

TO: PROSPECTIVE BIDDERS:

This Addendum forms a part of the Contract Documents and modifies the original Procurement Documents dated January 3, 2021, with amendments and additions noted below.

Acknowledge receipt of this Addendum in the space provided in the bid form. Failure to do so may disqualify the bidder**.**

CHANGES TO THE PROJECT MANUAL - INTRODUCTORY REQUIREMENTS, PROCUREMENT REQUIREMENTS AND CONTRACTING REQUIREMENTS:

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SECTION 22 05 13 - COMMON ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

SECTION 22 05 16 - EXPANSION COMPENSATION FOR PLUMBING

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SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete plumbing system.

1.02 RELATED SECTIONS

A. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

B. Section 22 10 05 – Plumbing Piping.

C. Section 22 30 00 – Plumbing Equipment.

D. Section 22 40 00 – Plumbing Fixtures.

E. Section 31 23 16 – Excavation.

1.03 SITE INSPECTION

A. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

1.04 DRAWINGS

A. Mechanical drawings show general arrangement of piping ductwork, equipment, etc. Follow closely as actual building construction and work of other trades will permit.

B. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over mechanical drawings.

C. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves and accessories required, to meet the conditions.

D. Record differences between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings, to be furnished by Architect. Return these prints to Architect at completion of project. These will be labeled "Contractor Revised Drawings".

1.05 SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications is intended to establish a level of quality and performance. Substitution requests may be submitted at the time of shop drawing submittal. Review of substituted equipment or material prior to the Bid Date will not be considered unless otherwise specified.

B. Substitution shall be submitted as specified in Division 01.

1.06 CODE REQUIREMENTS, FEES & PERMITS

A. Perform work in accordance with applicable provisions of state and local Plumbing Code, gas ordinances and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations and ordinances.

B. In case of differences between building codes, state laws, local ordinances, utility company

regulations and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.

1.07 CONTRACTOR REVISED DRAWINGS

A. The contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. Exact location of all underground utility service entrances and their connections to utility mains, well heads, loop piping and all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances.

C. Upon completion of the work and prior to final payment, the contractor shall furnish to the Architect, one set of "contractor revised" prints, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

D. Contractor shall include all addendum items and field change order information on the revised drawings. Revise all schedules shown on the drawings to reflect the actual model numbers, capacities and electrical characteristics of substituted equipment.

1.08 COORDINATION OF WORK

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making application to Architect. Should conditions arise where certain changes would be advisable, secure Architect's approval of these changes before proceeding with the work.

B. Coordinate work of various trades in installing inter-related work. Before installation of mechanical items, make proper provisions to avoid interferences in a manner approved by Architect. Changes required in work specified in Division 22 caused by neglect to do so shall be made at no cost to Owner.

C. Provide inserts and supports required by Division 22 unless otherwise noted. Furnish sleeves, inserts, supports and equipment that are an integral part of other divisions of the Work to Sections involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location of installation of items above shall be borne by Division 22.

D. Be responsible for required digging, cutting and patching incident to work of this Division and make required repairs afterward to satisfaction of Architect. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns or trusses.
   1. Each Section of this Division shall bear expense of cutting, patching, repairing and replacing of work of other Sections required because of its fault, error and tardiness or because of damage done by it.
   2. Cutting, patching, repairing and replacing pavements, sidewalks, roads and curbs to permit installation of work of this Division is responsibility of Section installing work.

E. Adjust locations of pipes, etc. to accommodate work from interferences anticipated and encountered. Determine exact route and location of each pipe and duct prior to fabrication.
   1. Make offsets, transitions, and changes in direction of pipes, as required to maintain proper headroom and pitch of sloping lines whether or not indicated on Drawings.

F. Slots and openings through floors, walls, ceilings and roofs shall be provided by other Divisions in their respective materials. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.09 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulated therein shall be removed by pumping or by other approved method. Do sheeting and shoring as may be necessary for protection of the work and for safety of personnel. Excavation shall be by open cut except that short sections of trench may be tunneled if the pipe can be safety and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Bottom of trench for tile or concrete pipe shall be rounded so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. Grate bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil. Where rock is encountered, excavate to a minimum over-depth of 4" below trench depths indicated on the drawings or specified. Over-depths in rock excavation and unauthorized over-depths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered, such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of depth that will provide a minimum depth of cover of three feet for water, sanitary and storm sewer and two feet for gas piping from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

1.10 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until required pressure and other tests have been performed and inspections of utility and Code officials have been accomplished, and until the utilities systems as installed conform to requirements of drawings and specifications.

B. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones over 2-1/2 inch maximum dimension, deposited in 6 inch layers and compacted to 95% of the maximum laboratory density determined in accordance with ASTM D-698, Moisture-Density Relation of Soils. Tests for maximum density will be made with expense borne by contractor. If fills fail to meet the specified densities, the contractor shall remove and re-compact the fill until specified densities are achieved.

C. Tests for Displacement of Sewers: After the trench has been backfilled to 2 feet or more above the pipe, if the pipe shows poor alignment, displaced pipe, or any other defects, such defects shall be remedied by the contractor at his expense.

1.11 GENERAL PIPING INSTALLATION

A. Furnish and install a complete system of piping. The piping drawings are diagrammatic and indicate the general location and connections. If the size of any piping is not clearly evident, obtain instructions from the Architect before proceeding with the work. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the contractor from responsibility for the proper erection of systems of piping in every respect suitable for the work intended. Piping systems that are not to be installed complete shall be so noted.

B. Erection: Piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing. Remove all burrs and cutting slag by reaming or other cleaning methods. Changes in direction shall be made with fittings, except that bending of pipe will be permitted, providing a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles, or other malformation will not be acceptable. Piping shall be arranged so as not to interfere with removal of other equipment or devices nor to block access manholes or other access openings. Piping shall be installed to insure noiseless circulation.

C. Minimum slope of piping shall be in accordance with the following unless otherwise specifically shown on the drawings or specified:

Type of Piping Fluid Conveyed	System Component	Length for 1" Fall	Direction of Fall
Sewer, Sanitary	Main or Branch	4 feet	Direction of flow
Domestic Water	Main or branch	40 feet	Back to mains

Sanitary and storm drainage piping 4 inches in diameter and larger may be pitched with one (1) inch fall for eight (8) foot lengths.

D. Protection: Open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the system. Plugs or rags, wood, cotton, concrete, waste or similar materials must not be used in plugging.

E. Installation of Underground Pipe: Bottom of trench shall be shaped to give substantially uniform circumferential support to lower third of each pipe. Pipe shall be laid true to line and grade in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, interior of pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swag or drain shall be kept in pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall be kept free from water until pipe jointing has set and pipe shall not be laid when condition of trench or weather is unsuitable for such work.

F. Cleaning and Flushing: Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be flushed with clean water except where specified otherwise.

G. Pipe Sizes: If the size of any piping is not clearly evident in the drawings, the contractor shall request instructions from the Architect as to the proper sizing. Any changes resulting from the contractor's failure to request clarification shall be at his expense.

1.12 THERMAL AND MOISTURE PROTECTION

A. Install flashing, counterflashing and caulk or seal all penetrations in exterior walls or floors as required to prevent exterior moisture from entering building.

1.13 EQUIPMENT AND MATERIALS

A. Product Approvals:
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in specification.

B. Use domestic made pipe, pipe-fittings and motors on project.

C. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connection and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

D. Follow Manufacturer's directions in delivery, storage, protection and installation of equipment and materials.
   1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and manufacturer's directions and obtain Architect's written instructions before proceeding with work. Bear expenses arising from correcting deficiencies of work that do not comply with Manufacturer's directions or such written instructions from Architect.

E. Deliver equipment and material to site and tightly cover to protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls), in a dry, heated space.

1.14 REVIEW OF MATERIALS AND EQUIPMENT

A. Furnish complete catalog data for manufactured items of equipment to be used in Work to architect for review within 30 days after award of Contract.

B. Submit six (6) copies of data in 3-ring binders with tab indices in same order and name as they appear in specification.
   1. State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions and other pertinent information. Pertinent information shall include as a minimum those items as scheduled on the drawings. Arrange submittal information to reflect these categories scheduled on the drawings.
   2. Provide an index of tab numbers at the front of each binder. List the specification number and category included under each tab as described in the specifications and as scheduled on the drawings.
   3. Provide cover sheet for each tab section. List each piece of equipment by name, model number and supplier.
   4. Underline applicable data and indicate model being supplied on each submittal sheet.

C. If data is not submitted as specified or submittal is not complete, it will be returned without review.

D. Catalog data or shop drawings for equipment which are noted as being reviewed by the Architect, shall not supersede Contract Documents.

E. Review comments of Architect shall not relieve this Division from responsibility for deviations from Contract Documents unless Architects' attention has been called to such deviations in writing at the time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

F. Check work described in catalog data with Contract Documents for deviations and errors.

1.15 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or in the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance of the Architect, provide any service incidental to the proper performance of the mechanical systems under guarantees outlined above for a period of one (1) year.

1.16 FINALLY

A. It is the intention that this specification shall provide a complete installation except as hereinbefore specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included.

B. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

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SECTION 22 05 13

COMMON ELECTRICAL REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section specifies the basic requirements for electrical components which are an integral part of packaged PLUMBING equipment. These components include, but are not limited to factory-installed motors furnished as an integral part of plumbing equipment.

B. This section specifies the basic requirements for electrical components required to be furnished under Division 22, which are to be turned over to and installed by Division 26. These components include but are not limited to motors.

C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for plumbing equipment are scheduled on the drawings.

1.02 RELATED SECTIONS

A. Section 22 30 00 – Plumbing Equipment.

1.03 REFERENCES

A. NEMA Standards MG-1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NFPA 70).

F. Compliance and Labeling: Provide motors and starters which have been listed and labeled by a nationally recognized testing facility engaged in and equipped to test electrical equipment and materials.

1.04 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.05 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

A. The following are basic requirements for simple or common motors, for special motors detailed and specific requirements are specified in the individual equipment specifications.
   1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
   2. Motor sizes shall be large enough so that driven load will not requirement the motor to operate in the service factor range.
   3. 2-speed motors shall be 2 separate windings, on a polyphase motor.
   4. Temperature Rating: Rated for 40 deg. environment, with maximum 50 °C temperature rise for continuous duty at full load (Class A Insulation).
   5. Starting capability: Frequency of starts as indicated by automatic control system and not less than 5 evenly timed spaced starts per hour for manually controlled motors.

6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

B. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
   1. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
   2. Bearings:
      a. Ball or roller bearings with inner and outer shaft seals;
      b. Regreaseable bearings, except permanently sealed where motor is normally inaccessible for regular maintenance.
      c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
      d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
   3. Enclosure Type:
      a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
      b. Guarded drip-proof motors where exposed to contact by employees or building occupants;
      c. Weather protected Type I for outdoor use, Type II where not housed;
   4. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: "Quiet" rating on motors located in occupied spaces of building.
   6. Efficiency: Provide "Energy Efficient" motors with a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a minimum efficiency as listed below.

1HP	80% Efficiency	10HP	87%
1-1/2 to 2HP	82%	15HP	89%
3HP	83%	20HP	90%
5HP	84%	25HP and up	91%
7-1/2 HP	85%		

C. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
Baldor Electric Co.
Century Electric, Inc.
General Electric Co.
Marathon Electric Mfg. Co.
Reliance Electric Co.
Westinghouse Electric Corp.

D. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

SECTION 22 05 16

EXPANSION COMPENSATION FOR PLUMBING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for expansion compensation for the plumbing system.

1.02 RELATED SECTIONS

A. Section 22 05 84 – Vibration and Seismic controls for Plumbing Piping and Equipment.

B. Section 22 10 05 – Plumbing Piping.

C. Section 22 30 00 – Plumbing Equipment.

D. Section 22 40 00 – Plumbing Fixtures.

E. Section 31 23 16 – Excavation.

1.03 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of expansion compensation product. Submit schedule showing Manufacturer's figure number, size, location, and features for each required expansion compensation product.

B. Shop Drawings: Submit shop drawings for fabricated expansion loops indicating location, dimensions, pipe sizes, location and method of attachment of anchors.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of expansion compensation product. Include this data in Maintenance Manual.

1.04 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of expansion compensation products of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Comply with standards of the Expansion Joint Manufacturer's Association (EJMA).

PART 2 - PRODUCTS

2.01 PIPE ALIGNMENT GUIDES

A. General: Provide pipe alignment guides on both sides of expansion joints, and elsewhere as indicated. Construct with 4 finger spider traveling inside a guiding sleeve, with provision for anchoring to building substrate.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pipe alignment guides which may be incorporated in the work include, but are not limited to the following:
Keflex, Inc.
Metraflex (The) Co.

PART 3 - EXECUTION

3.01 EXPANSION LOOPS

A. General: Fabricate expansion loops as indicated, in locations indicated, and elsewhere as determined by Installer for adequate expansion of installed piping system. Subject loop to cold spring which will absorb 50% of total expansion between hot and cold conditions. Provide pipe

anchors and pipe alignment guides as indicated, and elsewhere as determined by Installer to properly anchor piping in relationship to expansion loops.

END OF SECTION

SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of meters and gauges specified in this section include the following:
   1. Temperature Gauges and Fittings:
      Glass Thermometers
      Dial Type Insertion Thermometers
      Thermometer Wells
      Temperature Gauge Connector Plugs
   2. Pressure Gauges and Fittings:
      Pressure Gauges
      Pressure Gauge Cocks
      Pressure Gauge Connector Plugs

C. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 22 sections.

1.02 RELATED SECTIONS

A. Section 22 10 05 – Plumbing Piping.

B. Section 22 30 00 – Plumbing Equipment.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of meters, gauges, and fittings, or types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

C. ANSI and ISA Compliances: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.04 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of meter, gauge and fitting. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter, gauge and fitting schedule shown manufacturer's figure number, scale range, location, and accessories for each meter, gauge and fitting.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of meter and gauge. Include this data in maintenance manual.

PART 2 - PRODUCTS

2.01 TEMPERATURE GAGES

A. Glass Thermometers:
   1. General: Provide glass thermometers of materials, capacities and ranges indicated, designed and constructed for use in service indicated.
   2. Case: Die cast aluminum, finished in baked epoxy enamel, clear acrylic plastic front, spring secure, 9 inches long.

3. Adjustable Joint: Die cast aluminum, finished to match case, 180 ° adjustment in vertical plane, 360 ° adjustment in horizontal plane, with locking device.
4. Tube and Capillary: Mercury filled, magnifying lens, 1 percent scale range accuracy, shock mounted.
5. Scale: Satin faced, non-reflective aluminum permanently etched markings.
6. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.
7. Range: Conform to the following:
   a. Hot Water: 30 - 240 °F with 2 °F scale divisions (0 ° - 160 °Celsius) with 1 °Celsius scale divisions.
   b. Chilled Water: 30 - 180 °F with 2 °F scale divisions (0 -100 °Celsius) with 1 °Celsius scale divisions.
8. Available Manufacturers: Subject to compliance with requirements, manufacturers offering glass thermometers which may be incorporated in the work include, but are not limited to, the following:
   Marshalltown Instruments, an Eltra Co.
   Trerice (H.O.) Co.
   Weiss (Albert A) & Son, Inc

B. Dial Type Insertion Thermometers:
1. General: Provide diameter type insertion thermometers of materials, capacities and ranges indicated, designed and constructed for use in service indicated.
2. Type: Bi-metal, stainless steel case and stem, 1 inch diameter dial, dust and leak proof, 1/8 inch diameter stem with nominal length of 5 inches.
3. Accuracy: 0.5 percent of dial range.
4. Range: Conform to the following:
   a. Hot Water: 0 - 220 °F (-10 ° - 110 °C).
5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial type insertion thermometers which may be incorporated in the work include, but are not limited to, the following:
   Marsh Instrument Co, Unit of General Signal.
   Taylor Instrument Process Control Div. of Sybron Corp.
   Trerice (H.O.) Co.
   Weiss (Albert A.) & Son, Inc

C. Thermometer Separable Wells:
1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2inch extension for insulated piping.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering thermometer wells which may be incorporated in the work include, but are not limited to the following:
   Marsh Instrument Co., Unit of General Signal.
   Trerice (H.O.) Co.
   Weiss (Albert A.) & Sons, Inc.

D. Temperature Gage Connector Plugs:
1. General: Provide temperature gage connector plugs pressure rated for 500 psi and 200 degrees F. Construct of brass and finish in nickel-plate, equip with 1/2 inch NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness for insulated piping.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering temperature gage connector plugs which may be incorporated in the work include, but are not limited to, the following:
   Peterson Engineering Co.

2.02 PRESSURE GAGES AND FITTINGS

A. Pressure Gages:
   1. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
   2. Type: General use, 1 percent accuracy, ANSI B40.1, Grade-A, phosphor bronze bourbon type, bottom connection.
   3. Case: Drawn steel or brass, clear acrylic plastic lends, 4-1/2 inch diameter.
   4. Connector: Brass with 1/4 inch male NPT. Provide protective syphon when used for steam service.
   5. Scale: White coated aluminum with permanent etched markings.
   6. Range: Conform to the following:
      a. Water: 0 - 100 psi.
   7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gauges which may be incorporated in the work include, but are not limited to, the following:
      Ametek, U.S. Gauge Div.
      Marsh Instrument Co., Unit of General Signal.
      Marshalltown, an Eltra Company
      Trerice (H.O.) Co.
      Weiss (Albert A.) & Son, Inc

B. Pressure Gage Cocks:
   1. General: Provide pressure gauge cocks between pressure gages and gauge tees on piping systems. Construct gage cock of brass with 1/4 inch female NPT on each end, and "T" handle brass plug.
   2. Syphon: 1/4 inch straight coil constructed of brass tubing with 1/2 inch male NPT on each end.
   3. Snubber: 1/4 inch brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.
   4. Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gage cocks which may be incorporated in the work include, but are not limited to, the following:
      Ametek, U.S. Gauge Div.
      Marsh Instrument Co., Unit of General Signal.
      Marshalltown, An Eltra Company
      Trerice (H.O.) Co.
      Weiss (Albert A.) & Son, Inc

C. Pressure Gage Connector Plugs:
   1. General: Provide pressure gage connector plugs pressure rated for 500 psi and 200 degrees Fahrenheit. Construct of brass and finish in nickel-plate, equip with 1/2 inch NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8 inch O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness for insulated piping.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gauge connector plugs which may be incorporated in the work include, but are not limited to, the following:
      Peterson Engineering Co.

PART 3 - EXECUTION

3.01 INSTALLATION OF TEMPERATURE GAGES

A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Thermometer Separable Wells: Install in piping for each temperature gage.

C. Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.02 INSTALLATION OF PRESSURE GAGES

A. General: Install pressure gages in piping with pressure gage cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:
   1. At suction and discharge of each hydronic pump or as a common gauge, if so detailed on drawings.
   2. At each pressure reducing valve on both the high pressure and low pressure sides.
   3. At water service outlet.

C. Pressure Gage Cocks: Install in piping tee with snubber.

D. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING

PART 1 - GENERAL

1.01 SCOPE

A. The requirements for seismic protection measures to be applied to plumbing equipment specified herein are in addition to any other items called for in other sections of these specifications. The seismic protection shall conform to Category D of the 2007 Arkansas Fire Prevention Code. The Plumbing equipment shall include the following items to the extent required on plans or in other sections of the following specifications:
Piping, 2-1/2 inches or larger
Components weighing more than 75 pounds
Water Heaters

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Requirements - Section.

1.03 APPLICABLE PUBLICATIONS

A. American Society of Civil Engineers: ASCE 7

B. Federal Specifications:
1. RR-W-410D

1.04 REGULATORY REQUIREMENTS

A. Conform to the 2007 Fire Prevention Code.

PART 2 - PRODUCTS

2.01 Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and shown.

2.02 Sway brace of structural steel conforming to ASTM A36.

2.03 Mechanical couplings of the sleeve type to provide a tight flexible joint under all reasonable conditions.

2.04 Square-head bolts and heavy hexagon nuts, ANSI B18.2.1 and B12.2.2 and ASTM A307or 306.

2.05 Guy wires where required shall conform to Fed Spec. RR-W-441 as follows:

5/32" diameter	Type V, Class 1
3/16" to 5/16" diameter	Type V, Class 2
1/4" to 5/8" diameter	Type I, Class 2

PART 3 - EXECUTION

3.01 All rigidly mounted equipment will have a minimum of four (4) anchor bolts securely fastened through bases or backs. Anchor bolts must conform to ASTM A307. Anchor bolts shall have an embedded, straight length equal to at least twelve times the nominal diameter of the bolt and shall conform to the applicable tables for various equipment weights.

Maximum Equipment Weight (Pounds)	
500	1/2
1,000	1/2
5,000	1/2
10,000	1/2
20,000	1/2
30,000	5/8

50,000	3/4
100,000	1

Based on four (4) bolts per item; a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters, and a minimum edge distance of 12 bolt diameters. Use an equivalent total cross-sectional area when more than four bolts per item are provided. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into the concrete floor or the foundation shall be increased in depth to accommodate bolt lengths. When the height-to-width ratio of the equipment exceeds 8.9, overturning must be investigated. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data are provided to verify the adequacy of the specific anchor and application. In no case shall the expansion anchor size be less than that required for bolts in the preceding table. Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure, except that an equipment weight equal to five times the actual equipment weight shall be used.

3.02 Equipment Sway Bracing shall be provided for all items supported from the overhead floor or roof structures. Braces shall consist of angles, rods, bars, or pipes run at a 45° angle from the equipment frame to the building structure secured at both ends with no less than 1/2 inch bolts. Braces shall conform to all applicable codes and standards for Seismic Classification. Bracing shall be provided in two planes of directions, 90° apart, for each item of equipment. Details of all equipment bracing shall be submitted for approval. Instead of bracing with vertical supports, these items may be supported with hangers inclined at 45°, provided that supporting members are properly sized to supporting the operating weight of equipment when inclined at a 45° angle.

3.03 Sway bracing shall be provided for all 2-1/2 inch or larger pipes, not individually supported with hangers 12 inches or less in length.

3.04 All components that weight more than 75 pounds shall have a safety chain or safety cable in addition to its other support.

3.05 Water heaters and pumps shall be bolted to the housekeeping pads per Paragraph 3.01.

3.06 Powder-activated fasteners (shot pins) shall not be used for anchorage.

3.07 Vibration isolators shall have a bumper restraint in each horizontal direction, and vertical restraints shall be provided where required to resist overturning.

3.08 Oversized plate washers extending to the equipment wall shall be used at bolted connections through the base sheet metal if the base is not reinforced with stiffeners or not capable of transferring the required loads.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Types of identification devices specified in this section include the following:
Plastic Pipe Markers
Valve Tags
Valve Schedule Frames
Engraved Plastic-Laminate Signs
Ceiling Tacks

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division 23 sections.

1.02 RELATED SECTIONS

A. Section 23 2113 – Hydronic Piping.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device desired.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space) and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 21 sections. Where more than single type is specified for application; selection is Installer's option, but provide single selection for each product category.

B. Plastic Pipe Markers:
1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
    a. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location,

fastened by one of the following methods:
(1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
(2) Adhesive lap joint in pipe marker overlap.
(3) Laminated or bonded application of pipe marker to pipe (or insulation).

b. Large Pipes: For external diameters of 6 inches and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
(1) Laminated or bonded application of pipe marker to pipe (or insulation)
(2) Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

c. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

d. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

e. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide, by 4 mil thick and manufactured for direct burial service.

C. Valve Tags:
1. At the Contractor's option, provide one of the following:
a. Brass Valve Tags: provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 inch high letters and sequenced valve numbers 1/2 inch high and with 5/32 inch hole for fastener. Provide 1-1/2 inch diameter tags, except as otherwise indicated.
b. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32 inch thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4 inch high letters and sequenced valve numbers 1/2 inch high, and with 5/32 inch hole for fastener. Provide 1-1/2 inch square black tags with white lettering, except as otherwise indicated.
2. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Valve Schedule Frames:
1. General: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

E. Engraved Plastic-Laminate Signs:
1. General: Provide engraving stock melamine plastic laminate, complying with FS L- P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/16 inch for units up to 20 square inches or 8 inch length; 1/8 inch for larger units.
3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic pipe markers which may be incorporated in the work include, but are not limited to, the following:
Seton Name Plate Company
EMED Co., Inc.
Approved equal

2.02 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/ maintenance of plumbing systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification:
   1. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces, (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.
      a. Near each valve and control device.
      b. Near each branch, excluding short take-offs for fixtures, mark each pipe at branch, where there could be question of flow pattern.
      c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
      d. At access doors, manholes and similar access points which permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination.
      f. Spaced intermittently at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
      g. On piping above removable acoustical ceilings.

C. Valve Identification:
   1. General: Provide valve tag on every valve, cock and control device in each piping system.
   2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
      a. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

D. Plumbing Equipment Identification:
   1. General: Install engraved plastic laminate sin on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
      a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Pumps and similar motor-driven units.
      c. Fans, blowers, primary balancing dampers and mixing boxes.
      d. Central-station units.
      e. Tanks and pressure vessels.
      f. Motor starters and other control equipment.

E. Refer to Division 22 sections for identification requirements at central-station mechanical control center; not work of this section.

F. Refer to Division 26 sections for identification requirements of electrical work; not work of this section.

G. Lettering Size: Minimum 3/8 inch high lettering for name of unity where viewing distance is less than 2'-0"; 3/4 inch high for distances up to 6'-0"; and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

H. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

I. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Insulation Requirements for complete plumbing piping system.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 05 53 – Identification for Plumbing Piping

D. Section 22 10 05 – Plumbing Piping.

E. Section 22 30 00 – Plumbing Equipment.

F. Section 22 40 00 – Plumbing Fixtures.

1.03 REFERENCES

A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C195 - Mineral Fiber Thermal Insulation Cement.

C. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.

D. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

E. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

F. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

G. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.

H. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

I. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

J. ASTM E96 - Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/100 or less in accordance with ASTM E84, NFPA 255, and UL 723.

1.06 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 22 0500.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

PART 2 - PRODUCTS

2.01 GLASS FIBER

A. Insulation: ASTM C547; rigid molded, noncombustible.
   1. "K" value: ASTM C335, 0.24 at 75 °F.
   2. Minimum Service Temperature: -20 °F.
   3. Maximum Service Temperature: 850 °F.
   4. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket:
   1. ASTM C921, white Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Transmission: ASTM E96; 0.02 perm inches.
   3. Secure with adhesive applied to longitudinal laps and butt strips.
   4. Secure with vapor barrier mastic.
   5. Self-sealing laps may be used provided lap seal is additionally sealed with vapor barrier masters.
   6. Maximum Water Vapor Transmission: 0.1 perm.

2.02 APPROVED MANUFACTURERS

A. Glass Fiber:
   1. Owens/Corning Fiberglass.
   2. Architect Approved - Other acceptable manufacturers offering equivalent products.

B. Vapor Barrier Jacket Lap-Adhesive - Compatible with insulation:
   1. Foster 25.
   2. Architect Approved.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. On exposed piping, locate insulation and cover seams in least visible locations.

C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory applied or field applied.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.

3. Finish with glass cloth and vapor barrier adhesive.
4. PVC fitting covers may be used.
5. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
6. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. For insulated pipes conveying fluids above ambient temperature:
1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
3. Finish with glass cloth and adhesive.
4. PVC fitting covers may be used.
5. For hot piping conveying fluids 140 °F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
6. For hot piping conveying fluids over 140 °F, insulate flanges and unions at equipment.

E. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

F. Finish insulation at supports, protrusions, and interruptions.

G. For exterior applications, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum or stainless steel jacket with seams located on bottom side of horizontal piping.

H. For buried piping, provide factory fabricated assembly with inner all-purpose service jacket with self sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

I. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size it large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

J. Valves and fittings insulated with block insulation shall be finished with insulating cement and troweled to a smooth and uniform finish.

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 GLASS FIBER INSULATION SCHEDULE

A.

PIPING SYSTEMS	THICKNESS
Plumbing Systems	
Domestic Hot Water Supply	1 inch
Domestic Hot Water Recirculation	1 inch
Domestic Cold Water (Indoors)	1/2 inch
Domestic Cold Water (Out of Doors)	1 inch

END OF SECTION

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SECTION 22 10 05

PLUMBING PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete plumbing piping system.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 48 – Vibration and Seismic Controls for Plumbing.

C. Section 22 05 53 – Identification for Plumbing Piping and Equipment.

D. Section 22 30 00 – Plumbing Equipment.

E. Section 22 40 00 – Plumbing Fixtures.

F. Section 31 23 16 – Excavation.

1.03 QUALITY ASSURANCE

A. Manufacturers shall be firms regularly engaged in manufacturer of plumbing piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer shall be a firm with at least 3 years of successful installation experience on projects with plumbing piping system work similar to that required for project.

C. Comply with applicable provisions of ANSI B31.2 “Fuel Gas Piping”, applicable provisions of NFPA 54 (ANSI Z223.1) “National Fuel Gas Code”, ANSI Z223.1a “Supplement to National Fuel Gas Code” and with requirements of the local gas company.

D. Comply with applicable codes and standards.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 05 00.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Manufacturer’s Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years experience.

PART 2 - PRODUCTS

2.01 DOMESTIC HOT AND COLD WATER SYSTEMS

A. PIPE
   1. Type “K” hard drawn copper, as made by Mueller Brass Co., for piping underground or beneath concrete slab.
   2. Type “L” hard drawn copper, as manufactured by Mueller Brass Co., for above ground applications.

B. FITTINGS
   1. Wrought copper.

C. CONNECTIONS
1. Sweat copper type with Stay-Safe “Bridgit” lead free silver bearing solder with Stay-Clean liquid or Stay-Clean paste flux as manufactured by J. W. Harris Co., Inc. Joints under slabs shall be brazed with Silfos brazing alloy.

D. VALVES
1. Use gate valves exclusively unless otherwise specified. All valves shall be by a single manufacturer from the approved list (reference Section 22 1006). Valves shall be for 150psi SWP.
2. All valves shall be brass, of screwed pattern, gland stuffing box, solid wedge double seal for gate valves, non-rising stem.

E. UNIONS
1. All union connections on piping 2” and smaller shall be ground joint brass union, having brass taper seat and both screw ends hexagonal and shall be designed for a steam working pressure up to 150 pound.

F. ORIGIN
1. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

2.02 SANITARY SEWER, SOIL, WASTE VENT AND STORM PIPING SYSTEMS

A. Piping Above-Floor – PVC Drainage Pipe:
1. All piping shall be PVC (polyvinyl chloride), Schedule 40, DWV, ASTM D-2655-77 with NFS seal of approval. PVC-DWV pipe shall be marked as prescribed in ASTM D-2665 to indicate the manufacturer’s name or trademark, the ASTM designation Number D-2665, the nominal pipe size, the material abbreviation PVC and the product abbreviation DWV spaced along the entire pipe length at not more than 2 foot intervals. All pipe and fittings shall be the product of one manufacturer. Pipe shall be stored in lifts and loose pipe shall be stored on racks with a minimum support spacing of 3 feet. Pipe shall be shaded but not covered directly when stored outside in high temperatures. All pipe and fittings shall be approved by the Arkansas State Plumbing Code.
2. Generally, conventional pipe support hanger systems may be used but spacing must be 4 or 5 feet, branch fittings serving trap arms should also be secured to the framing to prevent movement. Hanger straps shall not be so tight as to compress, distort, cut or abrade the piping.
3. Vertical sections and their connecting branches and components shall be secured at each stack base and at sufficiently close intervals to keep the system in alignment and to adequately support the weight of the pipe and its contents.
4. Waste arms for lavatories and urinals shall be DWV copper with cast brass adapters and wrought copper fittings and lead free solder.
5. Exception:
   a. Exception: The kitchen area shall be piped with cast iron hub-less type waste piping (above floor) to withstand very hot water and frequent rodding.

B. Piping Below-Grade – PVC Drainage Pipe:
1. All piping below grade shall be PVC, Schedule 40, DWV, ASTM D-2655, shall adhere to the installation standards set forth in ASTM D2321 or its equivalent and the bedding and backfilling of PVC pipe shall be completed as described below.
2. For all PVC pipe, the trench excavation shall be extended to a minimum depth of 6 inches below the bottom of the pipe. Where additional excavation is required due to unacceptable soil conditions, the trench bottom shall be brought back up to grade, using Class I or II bedding materials. This bedding material shall be installed in no greater than 8 inch compacted lifts. All bedding material shall be compacted to a minimum density of 90 percent modified proctor as outlined in AASHTO-T180. The intent of this bedding is to provide uniform support for the flexible pipe. The remaining backfill shall be in accordance

to the standard details and trench requirements. The Class I or II material shall extend for 6 inches below the pipe to 6 inches above the pipe. The maximum depth of bury for PVC pipe shall be 16 feet. Any depths greater than 16 feet shall require rigid pipe.

C. Soil, waste, drain and vent piping must be of sizes noted and run as indicated on the drawings, and shall be given a uniform grade of ¼ inch per foot wherever possible, but in no case less than 1/8 inch per foot. The soil and waste pipes shall be extended through the roof. Each riser extending through the roof shall project 14" above roofline. Flashing shall be by roofing contractor. Counter flashing shall be by plumbing contractor. Where so shown, connect vents below roof.

D. Piping Exterior of Building:
   1. Sanitary sewer pipe and fittings (exterior of the building) shall be Schedule 40 PVC pipe, same as waste piping.

E. PIPE JOINTS
   1. PVC Solvent Welded Joints:
      a. All joints shall first be primed with purple primer/cleaner manufactured for PVC pipe. Do not use water, rags, gasoline, sandpaper or other substitutes for cleaning PVC surfaces.
      b. The cement shall be a bodied cement of approximately 800 to 1000 centipoise viscosity containing 10-20 percent (by weight) virgin PVC material solvated with tetrahydrofuran (THF). Select the proper cement (Schedule 40-cement for PVC shall be used with Schedule 40 PC pipe).
      c. Do not use all-purpose cements, ABS cement to joint PVC pipe and fittings. Apply cement with recommended applicators or pure bristle type paintbrush or the recommended size.
      d. All piping shall be cut squarely and deburred. Remove all excess cement from around the pipe and fittings with a dry cotton rag while cement is still soft. Do not attempt cementing in the rain or the presence of moisture.

F. CLEANOUTS
   1. Cleanouts shall be provided at the ends and points in change of direction of all drain, soil, and waste pipes and branches thereof, at the foot of each riser, at all offsets, in all horizontal runs at approximately 50 foot intervals for piping 4 inches and smaller and 100 feet for larger piping, and at other points where indicated on the plans or where required.
   2. All cleanouts in connection with cast iron pipe, except the traps and fittings on horizontal branches, shall have tapped "Y" fittings of same size as pipe up to 4 inches, and 4 inches for all larger pipes, closed with screw plugs. All other cleanouts in connection with cast iron pipe, except those that occur in finished floor and walls, shall have heavy cast iron ferrules same size as pipe up to 4 inches, and 4 inches for all larger pipe, caulked into hub and closed with a bronze screw plug.
   3. All cleanouts in finished floors shall be ZURN "LevelTrol" ZN-1400BP, Wade, or approved equal, with membrane anchorage pan and clamping collar, scoriated nickel-bronze access cover and adjustable frame; bronze cleanout plug shall be straight threaded with tapered shoulder that seals against caulked seat in body. Note the outlet must be "NL" Neo-Loc to accept PVC pipe.
   4. All cleanouts in finished walls shall be Zurn ZN-1443-BP, Wade or Jay R. Smith with polished nickel-bronze access cover and adjustable frame; bronze cleanout plus shall be straight threaded with tapered shoulder.
   5. All cleanouts on exterior piping of building shall be Zurn Z-1400-BP, Wade, or approved equal, as detailed on the drawings. Note the outlet must be "NL" Neo-Loc outlet to accept PVC piping.

2.03 TRAPS AND DRAINS

A. P-traps shall be placed under all floor drains and where indicated in wastes, and at other points

indicated on plans. P-traps shall be Schedule 40 PVC.

B. Drains shall be Zurn, or approved equal, in accordance with the schedule on the drawings. Note all floor drains shall have “NL” Neo-Loc outlet to accept PVC piping.

2.04 DRAIN PANS

A. All floor drains, except for those in concrete slab above earthfill, shall be provided with non-plasticized chlorinated polyethylene, "Chloraloy 240", brand concealed water proofing membrane as manufactured by the Noble Company of Grand Haven, Michigan, Compotite Corp. "Composeal", or approved equal. Membrane shall be medium gray in color, textured surface finish both sides, have white or black lettering continuously marked "Chloraloy 240", size 18 inches by 18 inches, turned up at least 1 inch, and meet applicable standards of ASTM. Complete installation shall be in accordance with manufacturer's recommendations.

2.05 ORIGIN

A. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.01 HOT AND COLD WATER PIPING SYSTEMS

A. For general piping insulation, see Section 22 0719.

B. Install copper tubing under slabs without joints where possible.

C. Provide adaptors in copper lines for all valves.

D. Locate cold water lines a minimum of 12 inches from hot water line.

E. Before pipes are covered, test systems in presence of Architect at 100 psi hydrostatic pressure for two (2) hours and show no leaks.

F. Sterilize domestic water system with solution containing at least 250 parts per million of available chloride. Introduce chlorinating materials into system in manner approved by Architect. Allow sterilization solution to remain for 24 hours and open and close valves and faucets several times during that time.

G. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

H. Water system will not be accepted until a negative bacteriological test is made on water taken from system and dosing shall be repeated as necessary until such negative test is accomplished. Submit written report of test to Architect for his approval.

I. Install water hammer arresters as noted on the drawings.

J. Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry weathertight. Provide gate valve at water service entry inside building, strainer, pressure gauge, test tee and valve.

K. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by National Standard Plumbing Code.

L. Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shut-off valve and union for each connection. Provide drain valve on drain connections.

3.02 SANITARY SEWER, SOIL, WASTE, VENT AND STORM PIPING SYSTEMS

A. Provide floor drains and other specialties as specified in the Schedule on the drawings and set forth in these specifications.

B. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have a seal trap in connection with a complete venting system so gasses pass freely to atmosphere with no pressure of syphon condition on water seal.

C. Before piping is covered, conduct tests in presence of Architect and correct leaks or defective work. Do not caulk threaded work. Fill waste and vent system to roof level (a minimum of 10 feet) with water and show no leaks for two (2) hours.

D. Vent entire system to atmosphere. Discharge 14 inches above roof. Joint lines together, in fewest practicable numbers before projecting above roof. Set back vent lines so they will not pierce roof near an edge or valley.

E. Flash pipes passing through roof with six (6) lb. / sq. ft. lead flashing fitted around pipes and turned down into pipe 1/2 inch with turned edge hammered against pipe wall.

END OF SECTION

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SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Valves and piping specialties, for complete Plumbing System.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 53 – Identification for Plumbing Piping.

C. Section 22 05 84 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 10 05 – Plumbing Piping.

E. Section 22 30 00 – Plumbing Equipment.

F. Section 22 40 00 – Plumbing Fixtures.

G. Section 31 23 16 – Excavation.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

1.04 SUBMITTALS

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for pipeline strainers. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required pipeline strainer.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of pipeline strainer. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 MANUFACTURED PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Pipe Escutcheons:
   1. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
   2. Pipe Escutcheons for Moist and Wet Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
   3. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

C. Low Pressure Y-Type Pipeline Strainers:
   1. General: Comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64 inch perforations at 233 sq. in. Mechanical grooved type strainer may be used in grooved piping system.
   2. Threaded ends, 2 Inches and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
   3. Flanged Ends, 2-1/2 Inches and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
   4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure Y-type strainers which may be incorporated in the work include, but are not limited to, the following:
      American Air Filter, an Allis-Chalmers Co.
      Armstrong Machine Works.
      Hoffman Specialty, ITT Fluid Handling Div.
      Metraflex Co.
      Sarco Co., Div. of White Consolidated.
      Trerice (H.O.) Co.
      Victaulic Co. of America

D. High Pressure Y-Type Pipeline Strainers:
   1. General: Comply with FCI 73-1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 250 psi working pressure, with Type 304 stainless steel screens, with 3/64" perforations at 233 sq. in. Mechanical grooved type strainer may be used in grooved piping systems.
   2. Threaded Ends, 2 Inches and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
   3. Flanged Ends, 2-1/2 Inches and Larger: Cast-iron body and bolted steel retainer with off-center blowdown fitted with pipe plug.
   4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure Y-type strainers which may be incorporated in the work include, but are not limited to, the following:
      American Air Filter, an Allis-Chalmers Co.
      Armstrong Machine Works.
      Hoffman Specialty, ITT Fluid Handling Div.
      Metraflex Co.
      Sarco Co., Div. of White Consolidated.
      Trerice (H.O.) Co.
      Victaulic Co. of America

E. Dielectric Unions:
   1. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolates ferrous from non-ferrous piping (electrical conductance), present galvanic action, and stop corrosion.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include, but are not limited to, the following:
      Atlas Products Co.
      Capital Mfg. Co., Div. of Harsco Corp.
      Eclipse, Inc.
      Epco Sales, Inc.
      FMC Corp.
      McNally, Inc.
      PSI Industries

Stockham Valves and Fittings

2.02 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from not less than 18-gauge corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2 inches. Reinforce top, either by structural angles or by rolling top over 1/4 inch steel rod. Provide hole, gasket and flange at low point for watertight joint and 1" drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap-lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3 inches and smaller, 20-gauge; 4 inches to 6 inches, 16-gauge; over 6 inches, 14-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe, remove burrs.
   3. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe, remove burrs.

C. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
   1. Lead and Oakum: Caulked between sleeve and pipe.
   2. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical sleeve seals which may be incorporated in the work include, but are not limited to following:
   Thunderline Corp.

2.03 VALVES

A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.04 GATE VALVES

A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Comply with the following standards.
   1. Cast-Iron Valves: MSS SP-70.
   2. Bronze Valves: MSS SP-80.
   3. Steel Valves: ANSI B16.34.

C. For Domestic Water Service:
   1. Flanged Ends 2-1/2 inches and larger: Class 125, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge, Nibco F-617-0.

D. For Fire Protection Service:
   1. Threaded Ends 2 inches and smaller: Class 200, bronze body, yoke bonnet, rising stem, OS&Y, solid wedge, UL/FM approved, Stockham B-133.
   2. Flanged Ends 2-1/2 inches and larger: Class 200, iron body, bolted bonnet, rising stem, OS&Y, solid wedge, UL/FM approved, Stockham G-634.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to, the following:

1. Milwaukee Valve Company.
2. NIBCO Valve Company.
3. Stockham Valves and Fittings, Inc.

2.05 GLOBE VALVES

A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Composition Discs: Where required, provide suitable material for intended service. For stem throttling service, fit composition disc valve with throttling nut. For metal seated globe valves, provide hardened stainless steel disc and seat ring.

C. Comply with the following standard:
   1. Cast-Iron Valves: MSS SP-85.
   2. Bronze Valves: MSS SP-80.
   3. Steel Valves: ANSI B16.34.

D. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 150, bronze body, union bonnet, rising stem, composition disc, NIBCO No. T-211Y.
   2. Flanged Ends 2-1/2 inches and larger: Class 125, iron body, bronze trimmed, bolted bonnet, rising stem, OS&Y, renewable seat and disc, NIBCO F-718-B.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering globe valves which may be incorporated in the work include, but are not limited to, the following:
   1. Milwaukee Valve Company.
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.

2.06 DRAIN VALVES

A. For Low Pressure Drainage Service:
   1. Threaded Ends 2 Inches and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4 inch hose outlet connection, Milwaukee 1152M.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drain valves which may be incorporated in the work include, but are not limited to, the following:
      a. Milwaukee Valve Company.
      b. NIBCO Valve Company.
      c. Stockham Valves and Fittings, Inc.

2.07 BALL VALVES

A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

B. Comply with the following standards:
   1. Steel Valves: ANSI B16.34.

C. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 125, bronze 2 piece body, stainless steel ball, bronze, extended stem, Apollo 77c – 14X-04.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work include, but are not limited to the, the following:
   1. Milwaukee Valve Company.
   2. NIBCO Valve Company.

3. Stockham Valves and Fittings, Inc.
4. Apollo: 77c-100 Series.

2.08 SWING CHECK VALVES

A. General: Construct pressure containing parts of valves as follows:
   1. Bronze Valves, 125 or 150 psi: ANSI/ASTM B62.
   2. Metallic Seated Bronze Valves, 200 or 300 psi: ANSI/ASTM B61.
   3. Iron Body Valves: ANSI/ASTM A126, Grade B.

B. Comply with MSS SP-71 for design, workmanship, material, and testing.

C. Construct valves of pressure castings free of any impregnating materials.

D. Construct valves of bronze, regrinding, with seating angle 40 to 45 °, unless composition disc is specified.

E. Provide stop plug as renewable stop for disc hanger, unless otherwise specified.

F. Construct disc and hanger as separate parts, with disc free to rotate.

G. Support hanger pins on both ends by removable side plugs.

H. For Domestic Water Service:
   1. Threaded Ends 2 inches and smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc, NIBCO T-413-Y-LF.
   2. Flanged Ends 2-1/2 inches and larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, cast-bronze disc, NIBCO F-918-B.

I. For Fire Protection System:
   1. Threaded Ends 2 inches and smaller: Class 200, bronze body, bolted cap, horizontal swing, composition disc, UL listed, Stockham B-305-B.
   2. Flanged Ends 2-1/2 inches and larger: Class 2005, iron body bronze mounted, bolted cap, horizontal swing, malleable iron disc, UL/FM approved, Stockham G-939.

J. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to, the following:
   1. Milwaukee Valve Company
   2. NIBCO Valve Company.
   3. Stockham Valves and Fittings, Inc.

2.09 VALVE FEATURES

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1.

B. Bypass: Comply with MSS SP-45, and except as otherwise indicated provide manufacturer's standard bypass piping and valving.

C. Drain: Comply with MSS SP-45, and provide threaded pipe plug complying with Division 15 "Pipe, Tube, and Fittings" section.

D. Flanged: Valve flanges complying with ANSI B16.5 (steel) or ANSI B16.24 (bronze).

E. Threaded: Valve ends complying with ANSI B2.1.

F. Butt-Welding: Valve ends complying with ANSI B16.25.

G. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

H. Wafer: Flangeless valves.

I. Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry.

J. Non-Metallic Disc: Non-metallic material selected for service indicated in accordance with manufacturer's published literature.

K. Renewable Seat: Design seat of valve with removable disc, and assembly valve so disc can be replaced when worn.

L. Extended Stem: Increase stem length by 2 inches minimum, to accommodate insulation applied over valve.

M. Mechanical Actuator: Factory-fabricated gears, gear enclosure, external chain attachment, and chain designed to provide mechanical advantage in operating valve.

N. Bonnet: Part of gate or globe valve through which stem passes to valve body, and attached to valve body by screws, bolts, union, or welding.

O. Solid Wedge: One-piece tapered disc in gate valve, designed for contact on both sides.

P. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.

2.10 PLUG VALVES (COCKS) (For Complete Gas Valve Specifications See Section 22 1005)

A. Valve body shall be screw pattern, iron, except that sizes 1-1/4 inches through 2 inches shall be semi-steel, rated for 125 psig, non-shock W.O.G. operating pressure.

B. Plug shall be tapered, lubricated brass with square head operator.

C. APPROVED MANUFACTURERS
1. 1-inch and smaller - A. Y. McDonnel Manufacturing Company #10686.
2. 1-1/4 inches through 1-1/2 inches - Nordstrom #114.
3. 2-1/2 inches and larger - Nordstrom #115.
4. Architect Approved.

2.11 PRESSURE RELIEF VALVES

A. Body: Bronze or iron with testing lever.

B. Trim: Bronze or stainless steel.

C. Construction: Comply with ASME Code for Pressure Vessels, Section VIII and shall bear ASME stamp.

D. Maximum Permissible over Pressure: 25 percent (water).

E. APPROVED MANUFACTURERS
1. Bell and Gossett.
2. McDonnell Miller.
3. Kunkle Valve Company.

2.12 PRESSURE REDUCING VALVES

A. Body: Cast iron.

B. Trim: Bronze.

C. Rating: 125 psig working pressure at 200 °F.

D. Operator: Spring loaded diaphragm with adjustable range.

E. Diaphragms and Disc: Nitrile.

F. Pressure Reducing Valves - Water Service:
1. Spence Regulators - Type D 34.
2. Watts Regulators.
3. Architect Approved.

2.13 BACK FLOW PREVENTERS

A. Reduced pressure type. Rated 175 psig at 140 °F and manufactured in the United States of America.

B. Body:
1. Bronze construction.
2. Bronze body test cocks.
3. NPT body connections.
4. Non-rising stem gate valves.

C. Check Valve:
1. Celcon seats.
2. Rubber check valve.

D. Relief Valve:
1. Stainless steel seat.
2. Stainless steel shaft and flange bolts.

E. APPROVED MANUFACTURERS
1. Watts Regulator Series 909-SAG.
2. Wilkins Regulators.
3. Febco.

2.14 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevises: MSS Type 1.

C. Steel Double Bolt Pipe Clamps: MSS Type 3.

D. Adjustable Swivel Pipe Rings: MSS Type 6.

E. Split Pipe Rings: MSS Type 11.

F. Extension Split Pipe Clamps: MSS Type 12.

G. Pipe Saddle Supports: MSS Type 36, including steel pipe base support and cast-iron floor flange.

H. Pipe Stanchion Saddle: MSS Type 37, including steel pipe base support and cast-iron floor flange.

I. Adjustable Pipe Saddle Supports: MSS Type 38 including steel pipe base support and cast-iron floor flange.

J. Single Pipe Rolls: MSS Type 41.

K. Adjustable Roller Hangers: MSS Type 43.

2.15 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

C. Four-Bolt Riser Clamps: MSS Type 42.

2.16 HANGER ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13.

C. Swivel Turnbuckles: MSS Type 15.

D. Malleable Iron Sockets: MSS Type 16.

E. Steel Weldless Eye Nuts: MSS Type 17.

2.17 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Concrete Inserts: MSS Type 18.

C. Top Beam C-Clamps: MSS Type 19.

D. Side Beam or Channel Clamps: MSS Type 20.

E. Center Beam Clamps: MSS Type 21.

F. C-Clamps: MSS Type 23.

G. Top I-Beam Clamps: MSS Type 25.

H. Side I-Beam Clamps: MSS Type 27.

I. Steel I-Beam Clamps with Eye Nut: MSS Type 28.

J. Steel WF-Beam Clamps with Eye Nut: MSS Type 29.

K. Malleable Beam Clamps: MSS Type 30.

L. Steel Brackets: One of the following for indicated loading:
Light Duty: MSS Type 31.
Medium Duty: MSS Type 32.
Heavy Duty: MSS Type 33.

2.18 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields for piping hangers and supports, factory-fabricated, for all insulated piping. Side saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.19 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, but are not limited to the following:
C & S Mfg. Corp.
Carpenter and Patterson, Inc.
Elcen Metal Products Co.
F & S Central Mfg. Corp.
ITT Grinnell Corp.

2.20 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA Std. ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A36.

C. Cement Grout: Portland cement (ANSI/ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C404, Size No. 2). Mix at a ratio of 1.0 part cement to 3 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for load required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), by cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

PART 3 - EXECUTION

3.01 INSTALLATION OF MANUFACTURED PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2 inches and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment.
Pumps
Steam traps serving steam main drips
Temperature control valves

Pressure reducing valves
Temperature or pressure regulating valves

C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.02 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1 inch drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

B. Sleeves: Install pipe sleeves of types indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less that 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface except floor sleeve. Extend floor sleeves 1/4 inch above level floor finish, and 3/4 inch above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
   1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.
   2. Install iron-pipe sleeves at exterior penetrations, both above and below grade.
   3. Install steel-pipe sleeves except as otherwise indicated.

C. Sleeve Seals: Install in accordance with the following:
   1. Mechanical Sleeve Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

3.03 INSTALLATION OF VALVES

A. General: Except as otherwise indicated, comply with the following requirements.
   1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
   2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
   3. Ball valves shall not be substituted for gate valves or plug valves. Install ball valves only where shown on the Drawings.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

D. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator. Install bronze valves in steam and condensate service and in other services where corrosion is indicated or can be expected to occur.

E. Mechanical Actuators: Install mechanical actuator with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, boiler rooms; and where recommended by valve manufacturer because of valve size, pressure

differential or other operating condition making manual operation difficult.

F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.
   1. Pipe Size 2 inches and smaller: One of the following, at Installer's option:
      a. Threaded valves.
      b. Grooved-end valves (Fire Protection Only).
      c. Flanged valves.
   2. Pipe Size 2-1/2 inches and larger: One of the following, at Installer's option:
      a. Grooved-end valves (Fire Protection Only).
      b. Flanged valves.

G. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

H. Non-Metallic Disc: Limit selection and installation of valves with non-metallic discs to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.

I. Renewable Seats: Select and install valves with renewable seats except where otherwise indicated.

J. Fluid Control: Except as otherwise indicated, install, gate, ball, globe and butterfly valves to comply with ANSI B31.1. Where throttling is indicated or recognized as principal reason for valve, install globe or butterfly valve.

K. Installation of Check Valves:
   1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.
   2. Horizontal Lift Check Valve: Install in horizontal piping line with stem vertically upward, position for proper direction of flow.
   3. Vertical Lift Check Valve: Install in vertical piping line with upward flow with stem vertically upward.
   4. Spring Loaded Horizontal Lift Check Valve: Install in horizontal piping line with stem vertically upward, position for proper direction of flow.

3.04 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where shown on the plans with elbow and air gap, and as may be required to prevent cross contamination of potable water systems.

B. Pipe discharge drain to nearest floor drain.

3.05 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, (but not limited to), proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.06 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations, within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-59.

Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.07 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items.
   1. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except, as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
   2. Support fire-water piping independently of other piping.
   3. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

B. Provisions for Movement:
   1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion bends and similar units.
   2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
   3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

C. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install galvanized coated protective shields. Install Foam-Glas insulation saddles.
   3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.08 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximum recommended by manufacturer for each unit.

D. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors, as required to accommodate both expansion and contraction of piping.

3.09 ADJUSTMENT OF HANGERS AND SUPPORTS

A. Adjust hangers and supports and place grout as required under supports to bring piping to proper levels and elevations.

3.10 EQUIPMENT BASES

A. Concrete housekeeping bases will be provided as work of Division 3. Furnish to Contractor, scaled layouts of all required b bases with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Structural steel stands to be supported from housekeeping pad bases. Steel supports shall not be allowed to be in direct contact with slab floors.

END OF SECTION

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SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Water Heaters.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing.

B. Section 22 05 53 – Identification for Plumbing Piping

C. Section 22 05 84 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

D. Section 22 10 05 – Plumbing Piping.

E. Section 22 40 00 – Plumbing Fixtures.

1.03 REFERENCES

A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.

B. ASME Section VIII-D - Pressure Vessels: Boiler and Pressure Vessel Codes.

C. ANSI/NFPA 30 - Flammable and Combustible Liquids Code.

D. ANSI/NFPA 54 - National Fuel Gas Code.

E. ANSI/NFPA 70 - National Electrical Code.

F. ANSI/NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 05 00.

B. Shop Drawings:
   1. Include heat exchanger dimensions, size of tapping and performance data.
   2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapping and drains.

C. Product Data:
   1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA:

A. Submit under provisions of Division 01 and Section 22 05 00.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Arkansas State Plumbing Code.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products, are in conformance with

recommendations and requirements of the following organizations:
1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters Laboratories (UL).

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 REGULATORY REQUIREMENTS

A. Conform to AGA, NSF, NBBPVI, ANSI/NFPA 54, ANSI/NFPA 58, ANSI/NFPA 70, ANSI/UL 174, and ANSI/UL 1453 requirements for water heaters.

B. Conform to ASME Section VIIID for manufacture of pressure vessels for heat exchangers.

C. Conform to ASME Section VIIID, ANSI/NFPA 30, and ANSI/NFPA 31 for tanks.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 22 0500.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. Provide one-year warranty under provisions of hereinafter set forth.

B. Warranty: Include coverage of domestic water heaters and submersible sump pumps.

PART 2 - PRODUCTS

2.01 <u>WATER HEATERS – SEE DRAWINGS FOR WATER HEATER SCHEDULE</u>

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, ANSI/NFPA 54 and UL requirements.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Install tanks in accordance with manufacturer's instructions.

D. Pipe relief valves and drains to nearest floor drain or as noted on drawings.

E. Support Unit on 4” concrete housekeeping pad.

F. Make adjustments such that stored water temperature is set at 120° F (max).

3.02 GUARANTEE

A. The entire installation shall be guaranteed for one (1) year against defective equipment, materials and workmanship beginning on signing of substantial completion form.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Plumbing Fixtures.

1.02 RELATED SECTIONS

A. Section 22 05 00 – Common Work Results for Plumbing Piping and Equipment.

B. Section 22 05 84 – Vibration and Seismic Controls for Plumbing Piping and Equipment.

C. Section 22 10 05 – Plumbing Piping.

D. Section 22 30 00 – Plumbing Equipment.

1.03 QUALITY ASSURANCE

A. Die-cast zinc alloy will not be accepted.

B. All faucets, stops, and traps shall be of the same manufacturer unless herein noted otherwise.

C. Corrosion-resistant steel (CRS).
   1. CRS flat products shall conform to not less than chemical composition requirements of any 300 series steel specified in ASTM A276.
   2. Exposed surfaces shall have standard polish (ground and polished) equal to Finish No. 4 as specified in NAAMM.

D. All enameled ironware shall be acid resisting.

E. All fixtures shall be new and best of their respective kinds. They shall be non-absorbent throughout and free from waves, kiln marks or discoloration.

F. All surfaces coming in contact with walls, floors or surface of other fixtures shall be ground truly flat and shall be bedded with fine dental plaster before being caulked to wall with silicone sealant.

G. Job must be turned over to the Owner with all fixtures clean and free from damage. All fixtures including service sinks shall be protected during construction with application of material sufficient to prevent use and damage by personnel and equipment.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 22 0500.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim and finishes.

C. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 and Section 22 0500.

B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 22 0500.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in

place to protect fixtures and prevent use.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

B. Confirm that millwork is constructed with adequate provision for the installation of countertop lavatories and sinks.

1.08 WARRANTY

A. Provide year warranty under provisions of Section 22 05 00.

1.09 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the test by the basic designation only.
   1. American National Standards (ANSI):
      A112.1.2-42.....Air Gaps in Plumbing System
      A112.6.1M-79.....Supports for Off-the-Floor Plumbing Fixtures for Public Use
      A112.18.1M-79....Finished and Rough Brass Plumbing Fixture Fittings
      A112.19.1M-79....Enameled Cast Iron Plumbing Fixtures
      A112.19.2-82.....Vitreous China Plumbing Fixtures
   2. American Society for Testing and Materials (ASTM):
      A276-83.....Stainless and Heat-Resisting Steel Bars and Shapes
   3. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual.

PART 2 - PRODUCTS

2.01 GENERALLY

A. This contractor shall furnish and install complete all fixtures shown on the plans and hereinafter specified.

B. All fixtures shall be new and best of their respective kinds. They shall be non-absorbent throughout and free from waves, kiln marks or discoloration.

C. All surfaces coming in contact with walls, floors or surface of other fixtures shall be ground truly flat and shall be bedded with fine dental plaster before being caulked to wall with silicone sealant.

D. All fixtures shall have water hammer arresters equal to Zurn or Wade, installed in their water supplies as shown on Drawings or as recommended by the shock absorber manufacturer.

E. Provide polished chromium plated, heavy brass lock-shield loose key or screwdriver pattern angle stops, straight stops, or stops integral with faucet, with each compression type faucet whether specifically called for or not. Locate stops centrally above or below fixture in accessible location. Furnish keys for lock-shield stops to Owner upon completion of installation. All supplies shall be I.P.S. brass.

F. Traps shall be two piece chrome plated cast brass P-traps with cleanout and 17 gauge tubing outlet with escutcheon.

G. All escutcheons on supplies and wastes shall be heavy chrome plated cast brass set screw type.

H. All faucets throughout shall have removable units comprising all the wearing parts.

I. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

J. Unless specifically specified otherwise, all fixture trim, stops, and traps shall be of the same manufacturer.

K. Protect fixtures against use and damage during construction in a manner approved by the Architect. Job must be turned over to the Owner with all fixtures and trim clean and free from damage. Fixtures shall not be used during construction unless approved by the Owner and/or Architect/Engineer.

L. All sink and lavatory type plumbing fixtures to have loose key type stops and flexible supply risers (unless noted otherwise).

M. All exposed plumbing piping shall be chrome plated unless noted otherwise.

N. The Contractor must review the Architectural Drawings for exact location of plumbing fixtures and floor drains. If a plumbing fixture or floor drain is shown on the Architectural Drawings, it must be included in the Contract even if it does not appear on the Mechanical Drawings.

O. All thermostatic and pressure balancing mixing valves shall have check stops on the hot and cold supplies.

P. All hot and cold water supplies to plumbing fixtures or to shower heads shall have a “Drop Ell” fitting securely attached, inside wall, to prevent movement.

Q. All lavatory or sink fixtures designated for handicapped use must have insulation installed on the water supplies and P-trap equal to “Lav-Guard” by Truebro, Inc.

R. All drinking fountain bubblers shall be chrome-plated brass.

S. All lavatory and urinal waste arms shall be DWV copper with cast brass adapters and wrought copper fittings.

T. All water closet flush valves that have grab bars mounted on walls behind them shall have a minimum of 1-1/2 inch flush valve pipe offset to clear grab bar. Coordinate with Architectural drawings.

U. All handicapped water closet flush valves shall be roughed-in and installed so that the flush valve control will be on the wide side of the toilet stall. Contractor shall coordinate this.

V. All water closet flush valves shall have cast wall flange with set screw, and be supplied with sweat-solder adapter kits.

W. Check millwork architectural and shop drawings. Verify exact location and size of fixtures and openings before rough-in and installation. Coordinate with millwork supplier for special cutouts, blocking, special or additional supports, etc.

X. This contractor shall furnish and install all backing for lavatories, or any equipment requiring same.

Y. Job must be turned over to the Owner with all fixtures clean and free from damage.

Z. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers, unless noted otherwise on Drawings.

2.02 STOPS

A. Provide polished chromium plated, heavy brass lock-shield loose key or screw driver pattern angle stops, straight stops, or stops integral with faucet, with each type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture. Locate stops centrally above or below fixture in an accessible location with 6-inch minimum length chrome plated brass nipples from wall and escutcheon. Furnish keys for lock-shield stops to Owner upon completion of installation.

2.03 TRAPS

A. Two-piece chromium plated cast brass with cleanout and 17-gauge tubing outlet with cast brass set screw type escutcheon.

2.04 ESCUTCHEONS

A. All escutcheons on supplies and wastes shall be heavy pattern, chrome plated, cast brass set screw type.

2.05 FAUCETS

A. All faucets shall be provided with aerators unless specified otherwise and shall have removable units comprising all the wearing parts.

2.06 CARRIERS

A. Where water closets, lavatories or sinks are installed back-to-back, and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

2.07 ORIGIN

A. Unless specifically specified otherwise, all material and products shall be manufactured in the United States of America.

2.08 FIXTURES

A. The following catalog numbers are for reference as to type and quality.

SEE DRAWINGS FOR PLUMBING FIXTURE SCHEDULE

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be caulked with white or clear Silicone sealants, which complement the fixture color.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls, etc. with brass through bolts, toggle bolts, expansion bolts, or power set fasteners, as required. Exposed heads of bolts and nuts in finished rooms to be hexagonal, polished chromium-plated brass with rounded tops.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Install components level and plumb secured in place with wall carriers and bolts.

3.03 ADJUSTING

A. Adjust work under provisions of Section 22 0500.

B. Provide adjustment of all stops, valves faucets, etc., for intended water flow rates to fixtures, as required to eliminate excessive splashing, noise, or overflow.

C. Where water closet waste pipe has to be offset due to beam interference, provide correction and/or additional piping necessary to eliminate relocation of water closet.

3.04 CLEANING

A. At completion of all work, fixtures, exposed materials, accessible chases and equipment shall be thoroughly cleaned of all manufacture’s labels, papers, paint, paste, and other foreign material.

3.05 FIXTURE HEIGHTS

A. Install fixtures to heights above finished floor as herein specified and indicated on the Architectural drawings. Architectural drawings shall rule where discrepancies occur.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HEATING, VENTILATING AND AIR CONDITIONING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for complete heating, ventilating, and air conditioning system.

1.02 RELATED SECTIONS

A. Division 23 – All Sections.

B. Section 31 23 16 – Excavation.

1.03 SITE INSPECTION

A. Examine premises and understand the conditions which may affect the performance of work of this Division before submitting proposals for this work.

B. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

1.04 DRAWINGS

A. Mechanical drawings show the general arrangement of piping, ductwork, equipment, etc. Follow closely as actual building construction and work of other trades will permit.

B. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to the design and construction of buildings. These drawings take precedence over mechanical drawings.

C. Because of the small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structurally and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

D. Record the difference between mechanical work as installed and as shown in Contract Documents on a set of prints of mechanical drawings to be furnished by Architect. Return these prints to Architect after the project. These will be labeled "Contractor Revised Drawings".

1.05 SUBSTITUTIONS

A. The naming of specified items on the drawings or in the specifications is intended to establish a level of quality and performance. Substitution requests may be submitted at the time of shop drawing submittal. A review of substituted equipment or material before the Bid Date will not be considered unless otherwise specified.

B. Substitution shall be submitted as specified in Division 01.

1.06 CODE REQUIREMENTS, FEES & PERMITS

A. Perform work per applicable provisions of state and local Plumbing Code, gas ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.

B. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.

C. Obtain all required permits in connection with this work under the contract and pay all fees in connection therewith. Arrange with serving utility companies for the connection to all utilities and pay all charges for the same including inspection fees and meters if required.

1.07 OPERATIONS AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

A. Bind two (2) Operations & Maintenance Manuals for Mechanical Systems in 3-ring, hardback binders. The spine of each binder shall have the following lettering done in silk-screen:

OPERATION AND MAINTENANCE MANUAL
VETERANS' VILLAGE COMMUNITY CENTER
CITY OF JONESBORO
JONESBORO, ARKANSAS

1. Provide a master index at beginning of Manual showing items included. Include the name and phone number of the nearest supplier and Manufacturer's representative. Use plastic tab indexes for sections of Manual.
2. Step by step procedure to follow in putting each piece of mechanical equipment into operation.
3. Provide schematic control diagrams for each separate fan system, refrigeration system, heating system, control panel, etc. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, fire-stats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.
4. Provide diagram for electrical control system showing the wiring of related electrical control items such as fire-stats, fuses, interlocks, electrical switches, and relays.
5. Provide drawings of each temperature control panel identifying components on the panels and their function.

B. Maintenance instructions shall include:
1. Manufacturer's maintenance instructions for each piece of mechanical equipment installed in the project. Instructions shall include the name of the vendor, installation instructions, parts numbers and lists, operations instructions of equipment and maintenance, and lubrication instructions.
2. Summary list of mechanical equipment requiring lubrication showing the name of equipment, location, and type and frequency of lubrication.
3. List of mechanical equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

C. Air Balance and Test Run Reports.
1. Include a copy of air balance reports and certifications.
2. Include a copy of the operating test data.

D. Provide a complete set of approved shop drawing submittals as an Appendix item.

1.08 OPERATIONS AND MAINTENANCE INSTRUCTIONS

A. Instruct Owner/Owner's Representative in operation and maintenance of mechanical systems utilizing Operations and Maintenance Manual when so doing.

B. Minimum instruction periods shall be as follows:
1. Mechanical - Eight (8) hours.
2. Refrigeration - Eight (8) hours.

C. Instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made.

D. None of these instructional periods shall overlap another.

1.09 CONTRACTOR REVISED DRAWINGS

A. The contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. The exact location of all underground utility service entrances and their connections to utility mains, wellheads, loop piping, and all valves, etc., which will be concealed in the finished work shall be accurately indicated on the drawings by measured distances.

C. Upon completion of the work and before final payment, the contractor shall furnish to the Architect, one set of "contractor revised" prints, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

D. The contractor shall include all addendum items and field change order information on the revised drawings. Revise all schedules shown on the drawings to reflect the actual model numbers, capacities, and electrical characteristics of substituted equipment.

1.10 VISIT SITE

A. This contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause for extras after the contract is signed because of unforeseen conditions. Any existing electrical wiring and conduit, gas, water drainage piping encountered within the building area shall be relocated or removed where required by this contractor at no extra cost to the Owner.

1.11 COORDINATION OF WORK

A. It is understood that while Drawings are to be followed as closely as circumstances permit, this Division will be held responsible for the installation of systems according to the true intent and meaning of the Contract Documents. Anything not clear or in conflict will be explained by making an application to Architect. Should conditions arise where certain changes would be advisable, secure Architect's approval of these changes before proceeding with the work.

B. Coordinate work of various trades in installing inter-related work. Before installation of mechanical items, make proper provisions to avoid interferences in a manner approved by Architect. Changes required in work specified in Division 23 caused by neglect to do so shall be made at no cost to the Owner.

C. Provide inserts and supports required by Division 23 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other divisions of the Work to Sections involved insufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from an improper location of installation of items above shall be borne by Division 23.

D. Be responsible for required digging, cutting, and patching incident to work of this Division and make required repairs afterward to satisfaction of Architect. Cut carefully to minimize the necessity for repairs to existing work. Do not cut beams, columns, or trusses.
   1. Each Section of this Division shall bear the expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, and tardiness or because of damage done by it.
   2. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is the responsibility of Section installing work.

E. Adjust locations of pipes, etc. to accommodate work from interferences anticipated and encountered. Determine the exact route and location of each pipe and duct before fabrication.
   1. Make offsets, transitions, and changes in direction of pipes, as required to maintain proper headroom and pitch of sloping lines whether or not indicated on Drawings.

F. Slots and openings through floors, walls, ceilings, and roofs shall be provided by other Divisions in their respective materials. This Division shall see that they are properly located and do any cutting and patching caused by its neglect to do so.

1.12 EXCAVATION AND TRENCHING FOR PIPING

A. Excavate to the depths indicated on the Drawings or as otherwise specified. Excavated materials not required or suitable for backfill or fill shall be removed from the site. Do such grading as is necessary to prevent surface water from flowing into trenches or other excavations. Water accumulated therein shall be removed by pumping or by other approved methods. Do sheeting and shoring as may be necessary for the protection of the work and safety of personnel. Excavation shall be by open-cut except for that short sections of the trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: The bottom of the trench for tile or concrete pipe shall be rounded so that at least the bottom quadrant of the pipe rests firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. Grate bottom of trenches to provide uniform bearing and support for each section of pipe, on undisturbed soil. Where rock is encountered, excavate to a minimum over-depth of 4" below trench depths indicated on the drawings or specified. Over-depths in rock excavation and unauthorized over-depths shall be backfilled. Whenever wet or otherwise unstable soil incapable of properly supporting the pipe is encountered, such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of a depth that will provide a minimum depth of cover of three feet for water, sanitary and storm sewer, and two feet for gas piping from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

1.13 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until required pressure and other tests have been performed, an inspection of utility, and Code officials have been accomplished, and until the utility systems as installed conform to requirements of drawings and specifications.

B. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones over 2-1/2 inch maximum dimension, deposited in 6-inch layers and compacted to 95% of the maximum laboratory density determined per ASTM D-698, Moisture-Density Relation of Soils. Tests for maximum density will be made with expense borne by the contractor. If fills fail to meet the specified densities, the contractor shall remove and re-compact the fill until specified densities are achieved.

C. Tests for Displacement of Sewers: After the trench has been backfilled to 2 feet or more above the pipe, if the pipe shows poor alignment, displaced pipe, or any other defects, such defects shall be remedied by the contractor at his expense.

1.14 GENERAL PIPING INSTALLATION

A. Furnish and install a complete system of piping. The piping drawings are diagrammatic and indicate the general location and connections. If the size of any piping is not evident, obtain instructions from the Architect before proceeding with the work. The piping may have to be offset, lowered or raised as required or as directed at the site. This does not relieve the contractor from responsibility for the proper erection of systems of piping in every respect suitable for the work intended. Piping systems that are not to be installed completely shall be so noted.

B. Erection: Piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing. Remove all burrs and cutting slag by reaming or other cleaning methods. Changes in direction shall be made with fittings, except that bending of pipe will be permitted, providing a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles, or other malformation will not be acceptable. Piping shall be

arranged so as not to interfere with the removal of other equipment or devices, nor to block access manholes or other access openings. Piping shall be installed to ensure noiseless circulation.

C. A minimum slope of piping shall be per the following unless otherwise specifically shown on the drawings or specified:

Type of Piping Fluid Conveyed	System Component	Length for 1" Fall	Direction of Fall
Condensate	Return main	20 feet	Condensate flow
Freon	Main	20 feet	Direction of flow

D. Protection: Open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the system. Plugs or rags, wood, cotton, concrete, waste, or similar materials must not be used in plugging.

E. Installation of Underground Pipe: The bottom of the trench shall be shaped to give substantially uniform circumferential support to the lower third of each pipe. Pipe shall be laid true to line and grade in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swag or drain shall be kept in the pipe and pulled forward past each joint immediately after jointing has been completed. Trenches shall be kept free from water until pipe jointing has set and pipe shall not be laid when the condition of trench or weather is unsuitable for such work.

F. Cleaning and Flushing: The contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be flushed with clean water except where specified otherwise.

G. Pipe Sizes: If the size of any piping is not evident in the drawings, the contractor shall request instructions from the Architect as to the proper sizing. Any changes resulting from the contractor's failure to request clarification shall be at his expense.

1.15 THERMAL AND MOISTURE PROTECTION

A. Install flashing, counterflashing, and caulk or seal all penetrations in exterior walls or floors as required to prevent exterior moisture from entering the building.

1.16 EQUIPMENT AND MATERIALS

A. Product Approvals:
   1. If approval is received to use other than specified items, responsibility for specified capacities, and ensuring that items to be furnished will fit space available lies with this Division.
   2. In the event other than specified equipment is used and will not fit job site conditions, this Division assumes responsibility for replacement with items named in the specification.

B. Use domestic-made pipe, pipe fittings, and motors on the project.

C. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connection and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

D. Follow the Manufacturer's directions in delivery, storage, protection, and installation of equipment and materials.
   1. Promptly notify Architect in writing of conflicts between requirements of Contract Documents and manufacturer's directions and obtain Architect's written instructions before proceeding with work. Bear expenses arising from correcting deficiencies of work that do not comply with Manufacturer's directions or such written instructions from Architect.

E. Deliver equipment and material to the site and tightly cover to protect against dirt, water, and chemical or mechanical injury but have readily accessible for inspection. Store items subject to moisture damage (such as controls), in a dry, heated space.

1.17 REVIEW OF MATERIALS AND EQUIPMENT

A. Furnish complete catalog data for manufactured items of equipment to be used in Work to Architect for review within 30 days after award of Contract.

B. Submit all mechanical items in (1) complete submittal. Provide an index of all items submitted, including specification section number, in the order, they appear in the specifications.
   1. State sizes, capacities, brand names, motor HP, accessories, materials, gauges, dimensions, and other pertinent information. Pertinent information shall include as a minimum those items as scheduled on the drawings. Arrange submittal information to reflect these categories scheduled on the drawings.
   2. Provide an index of tab numbers at the front of each binder. List the specification number and category included under each tab as described in the specifications and as scheduled on the drawings.
   3. Provide a cover sheet for each tab section. List each piece of equipment by name, model number, and supplier.
   4. Underline applicable data and indicate the model being supplied on each submittal sheet.

C. If data is not submitted as specified or submittal is not complete, it will be returned without review.

D. Catalog data or shop drawings for equipment which are noted as being reviewed by the Architect, shall not supersede Contract Documents.

E. Review comments of Architect shall not relieve this Division from responsibility for deviations from Contract Documents unless Architect's attention has been called to such deviations in writing at the time of submission, nor shall they relieve this Division from responsibility for errors in items submitted.

F. Check work described in catalog data with Contract Documents for deviations and errors.

1.18 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or in the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance of the Architect, provide any service incidental to the proper performance of the mechanical systems under guarantees outlined above for one (1) year.

1.19 FINALLY

A. It is the intention that this specification shall provide a complete installation except as hereinbefore specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included.

B. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

Not Applicable.

END OF SECTION

SECTION 23 05 13

COMMON ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section specifies the basic requirements for electrical components which are an integral part of packaged HVAC equipment. These components include, but are not limited to factory installed motors furnished as an integral part of plumbing equipment.

B. This section specifies the basic requirements for electrical components required to be furnished under Division 23, which are to be turned over to and installed by Division 26. These components include but are not limited to motors.

C. Specific electrical requirements (i.e., horsepower and electrical characteristics) for plumbing equipment are scheduled on the drawings.

1.02 RELATED SECTIONS

A. Section 23 34 23 – HVAC Power Ventilators.

B. Section 23 62 13 – Air Cooled Outdoor Heat Pump Units.

C. Section 23 81 27 - Split System Air Handing Unit With Coils.

1.03 REFERENCES

A. NEMA Standards MG-1: Motors and Generators.

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NFPA 70).

F. Compliance and Labeling: Provide motors and starters which have been listed and labeled by a nationally recognized testing facility engaged in and equipped to test electrical equipment and materials.

1.04 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.05 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

A. The following are basic requirements for simple or common motors, for special motors, more detailed and specific requirements are specified in the individual equipment specifications.
   1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
   2. Motor sizes shall be large enough so that driven load will not requirement the motor to operate in the service factor range.
   3. 2-speed motors shall be 2 separate windings on polyphase motors.
   4. Temperature Rating: Rated for 40 deg. environment, with maximum 50 deg. C temperature rise for continuous duty at full load (Class “A Insulation).
   5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.
   6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

B. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
   1. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
   2. Bearings:
      a. Ball or roller bearings with inner and outer shaft seals;
      b. Regreasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
      c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
      d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
   3. Enclosure Type:
      a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
      b. Guarded drip-proof motors where exposed to contact by employees or building occupants;
      c. Weather protected Type I for outdoor use, Type II where not housed;
   4. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: "Quiet" rating on motors located in occupied spaces of building.
   6. Efficiency: Provide "Energy Efficient" motors with a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a minimum efficiency as listed below.

1HP	80% Eff'y	10HP	87%
1-1/2 to 2HP	82%	15HP	89%
3HP	83%	20HP	90%
5HP	84%	25HP and up	91%
7-1/2 HP	85%		

C. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:
Baldor Electric Co.

Century Electric, Inc.
General Electric Co.
Marathon Electric Mfg. Co.
Reliance Electric Co.
Westinghouse Electric Corp.

D. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

PART 3 - EXECUTION

(Not Applicable.)

END OF SECTION

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SECTION 23 05 29

HANGERS & SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and equipment hangers and supports.

B. Equipment bases and supports.

C. Sleeves and seals.

D. Flashing and sealing equipment and pipe stacks.

1.02 RELATED SECTIONS

A. Section 23 07 19 - Piping Insulation.

1.03 REFERENCES

A. ASME B31.2 - Fuel Gas Piping

B. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

1.04 SUBMITTALS

A. Submit under provisions of Section 23 05 00.

B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Water:
   1. Conform to ASME B31.9 and ASTM F708.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.03 FLASHING

A. Metal Flashing: 28-gauge 304 stainless steel.

B. Copper Flashing: 16 oz. / sq. ft.

C. Lead Flashing:
   1. Waterproofing: 6 lb. / sq. ft.

D. Caps: Steel, 22-gauge minimum; 16-gauge at fire-resistant elements.

2.04 SLEEVES

A. Sleeves for Pipes thru Non-fire Rated Floors: 18-gauge galvanized steel.

B. Sleeves for Pipes thru Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe.

C Sleeves for Ductwork and Pipes thru Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire-rated sleeves including seals, UL listed.

D. Sleeves for Round Ductwork: Galvanized steel.

E. Sleeves for Rectangular Ductwork: Galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install per manufacturer's instructions.

B. Coordinate wall and floor penetration sealant requirements with a general contractor.

3.02 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch space between the finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 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 on every floor. Support vertical cast iron pipe at each floor at the hub.

G. Where several pipes can be installed in parallel and at the 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 exposed steel hangers and supports. Hangers and supports located in crawl space, Pipe-shafts and suspended ceiling spaces are not considered exposed.

3.03 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, where indicated on Drawings, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00. Coordinate the exact size required for pads.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.04 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 4 inches minimum above-finished roof surface with lead worked one-inch minimum into a hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and calk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36-inch sheet size. Fasten flashing to drain clamp device.

D. The sealed floor drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; calk around the top edge. Use storm collars above roof jacks. Screw vertical flange section to the face of the curb.

3.05 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors one inch above the finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and calk. Provide close-fitting metal collar or escutcheon covers at both sides of penetration. Secure collar or escutcheon to prevent blow-out. Fire stopping materials shall meet the requirements of ASTM E119.

E. Install chrome-plated steel escutcheons at finished surfaces.

3.06 SCHEDULES

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
Inches	Feet	Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8

END OF SECTION

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SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The requirements for seismic protection measures to be applied to HVAC equipment specified herein are in addition to any other items called for in other sections of these specifications. The seismic protection shall conform to Design Category D of the 2012 Arkansas Fire Prevention Code. The HVAC equipment shall include the following items to the extent required on plans or in other sections of the following specifications:
   1. Air Handling Units
   2. Ductwork over 6sq. ft. in Area
   3. Components Weighing More than 75 Pounds

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Requirements - Section.

1.03 APPLICABLE PUBLICATIONS

A. American Society of Civil Engineers: ASCE 7

B. Federal Specifications:
   1. RR-W-410D

1.04 REGULATORY REQUIREMENTS

A. Conform to 2012 Fire Prevention Code.

PART 2 - PRODUCTS

2.01 Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

2.02 Sway brace of structural steel conforming with ASTM A36.

2.03 Mechanical couplings of the sleeve type to provide a tight flexible joint under all reasonable conditions.

2.04 Square-head bolts and heavy hexagon nuts, ANSI B18.2.1 and B12.2.2 and ASTM A307or 306.

2.05 Guy wires where required shall conform to Fed Spec. RR-W-441 as follows:

5/32" diameter	Type V, Class 1
3/16" to 5/16" diameter	Type V, Class 2
1/4" to 5/8" diameter	Type I, Class 2

PART 3 - EXECUTION

3.01 All rigidly mounted equipment will have a minimum of four (4) anchor bolts securely fastened through bases or backs. Anchor bolts must conform to ASTM A307. Anchor bolts shall have an embedded straight length equal to at least twelve times the nominal diameter of the bolt and shall conform to the applicable tables for various equipment weights.

Maximum Equipment Weight (Pounds)	
500	1/2
1,000	1/2
5,000	1/2
10,000	1/2
20,000	1/2
30,000	5/8
50,000	3/4
100,000	1

Based on four (4) bolts per item; a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Use equivalent total cross-sectional area when more than four bolts per item are provided. Anchor bolts that exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths. When height-to-width ratio of the equipment exceeds 8.9, overturning must be investigated. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data are provided to verify the adequacy of the specific anchor and application. In no case shall the expansion anchor size be less than that required for bolts in the preceding table. Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure, except that an equipment weight equal to five times the actual equipment weight shall be used

3.02 Equipment Sway Bracing shall be provided for all items supported from overhead floor or roof structures. Braces shall consist of angles, rods, bars, or pipes run at a 45° angle from the equipment frame to the building structure secured at both ends with no less than 1/2 inch bolts. Braces shall conform to all applicable codes and standards for Seismic Classification. Bracing shall be provided in two planes of directions, 90° apart, for each item of equipment. Details of all equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45°, provided that supporting members are properly sized to supporting operating weight of equipment when inclined at a 45° angle.

3.03 Sway bracing shall be provided for all 2-1/2 inch or larger pipes, not individually supported with hangers 12 inches or less in length.

3.04 Sway bracing shall be provided for ductwork over six (6) square feet in cross sectional area supported more than 12” from structure.

3.05 All terminals that weight more than 75 pounds shall have a safety chain or safety cable in addition to its other support.

3.06 Vibration isolators shall have a bumper restraint in each horizontal direction, and vertical restraints shall be provided where required to resist overturning.

3.07 Oversized plate washers extending to the equipment wall shall be used at bolted connections through the base sheet metal if the base is not reinforced with stiffeners or not capable of transferring the required loads.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division 23 sections.

B. Type of identification devices specified in this section, include the following:
Plastic Pipe Markers
Valve Tags
Valve Schedule Frames
Engraved Plastic-Laminate Signs
Ceiling Tacks
Thermostat Identification

C. Mechanical identification furnished as part of factory-fabricated equipment is specified as part of the equipment assembly in other Division 23 sections.

1.02 RELATED SECTIONS

A. Section 23 21 13 – Hydronic Piping.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.04 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device desired.

B. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten, and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number; piping system, system abbreviation (as shown on tag), location of the valve (room or space), and variations for identification, if any. Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in a margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

PART 2 - PRODUCTS

2.01 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-21 sections. Where more than a single type is specified for the application, the selection is the Installer's option but provides a single selection for each product category.

B. Plastic Pipe Markers:
1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.

a. Small Pipes: For external diameters less than 6 inches (including insulation if any), provide full-band pipe markers, extending 360° around the pipe at each location, fastened by one of the following methods:
   (1) Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   (2) Adhesive lap joint in pipe marker overlap.
   (3) Laminated or bonded application of pipe marker to pipe (or insulation).
b. Large Pipes: For external diameters of 6 inches and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   (1) Laminated or bonded application of pipe marker to pipe (or insulation)
   (2) Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
c. Lettering: Manufacturer's standard pre-printed nomenclature which best describes the piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
d. Arrows: Print each pipe marker with arrows indicating the direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.
e. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum of 6 inches wide X 4 mil thick, manufactured for direct burial service.

C. Valve Tags:
1. At the Contractor's option, provide one of the following:
   a. Brass Valve Tags: provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 inch high letters and sequenced valve numbers 1/2 inch high and with 5/32 inch hole for a fastener. Provide 1-1/2 inch diameter tags, except as otherwise indicated.
   b. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32 inch thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4 inch high letters and sequenced valve numbers 1/2 inch high, and with 5/32 inch hole for a fastener. Provide 1-1/2 inch square black tags with white lettering, except as otherwise indicated.
2. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded-type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Valve Schedule Frames:
1. General: For each page of the valve schedule, provide a glazed display frame, with screws for removable mounting on walls. Provide frames of rigid plastic or metal, with plastic glazing.

E. Engraved Plastic-Laminate Signs:
1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of the substrate.
2. Thickness: 1/16 inch for units up to 20 square inches or 8-inch length; 1/8 inch for larger units.
3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

F. Provide identification in or on all thermostats, CO2 Sensors, Humidistats, etc., indicating which unit number it serves.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic pipe markers which may be incorporated in the work include, but are not limited to, the following: Seton Name Plate Company

EMED Co., Inc.
Approved equal

2.02 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations, and other designations used in mechanical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by the manufacturer or as required for proper identification and operation/ maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of the same generic name are shown and specified, provide identification which indicates individual system number as well as service.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: Where identification is to be applied to surfaces that require insulation, painting, or other coverings or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification before installation of acoustical ceilings and similar removable concealment.

B. Ductwork Identification:
   1. General: Identify air supply, return, exhaust intake and relief ductwork with plastic signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).
   2. Location: In each space where ductwork is exposed, or concealed only by a removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacing along with exposed areas.
   3. Access Doors: Provide plastic-laminate type signs on each access door in ductwork and housings, indicating the purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.
   4. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticized tags may be installed for identification instead of specified signs, at Installer's option.

C. Piping System Identification:
   1. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces, (shafts, tunnels, plenums), exterior non-concealed locations and above removable acoustical ceilings.
      a. Near each valve and control device.
      b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at the branch, where there could be a question of flow pattern.
      c. Near locations where pipes pass through walls or floors/ceilings or enter non-accessible enclosures.
      d. At access doors, manholes and similar access points which permit a view of concealed piping.
      e. Near major equipment items and other points of origin and termination.
      f. Spaced intermittently at a maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
      g. On piping above removable acoustical ceilings.

D. Valve Identification:
   1. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture

faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in the valve schedule for each piping system.

2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
   a. Where more than one major machine room is shown for the project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than signet machine room.

E. Mechanical Equipment Identification:
   1. General: Install engraved plastic laminate sin on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
      a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Pumps and similar motor-driven units.
      c. Fans, blowers, primary balancing dampers, and mixing boxes.
      d. Central-station units.
      e. Tanks and pressure vessels.
      f. Motor starters and other control equipment.

F. Refer to Division-15 sections for identification requirements at the central-station mechanical control center; not work of this section.

G. Refer to Division-16 sections for identification requirements of electrical work; not work of this section.

H. Lettering Size: Minimum 3/8 inch high lettering for name of unity where the viewing distance is less than 2'-0"; 3/4 inch high for distances up to 6'-0"; and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.

I. Text of Signs: In addition to the name of the identified unit, provide lettering to distinguish between multiple units, and warn of hazards and improper operations.

J. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at the installer's option, be identified by the installation of plasticized tags instead of engraved plastic signs.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Testing, Balancing and Adjusting Heating, Ventilating, and Air Conditioning Systems.

1.02 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning.

B. Section 23 05 84 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 09 33 – Electronic and Electronic Control System for HVAC.

D. Section 23 31 00 – HVAC Ducts and Casings.

1.03 REFERENCES

A. AABC - National Standards for Field Measurement and Instrumentation, Total System Balance.

B. ASHRAE - 2007 Systems Handbook: Chapter 37, Testing, Adjusting, and Balancing.

C. NEBB - Procedural Standards for Testing, Balancing, and Adjusting of Environmental Systems.

1.04 SUBMITTALS

A. Submit the name of adjusting and balancing agency for approval within 30 days after the award of Contract.

B. Submit test reports as a submittal under provisions of Section 01300 and Section 15050.

C. Before commencing work, submit draft reports indicating adjusting, balancing, and equipment data required.

D. Submit draft copies of the report for review before final acceptance of the Project. Provide final copies for Architect/Engineers and inclusion in operating and maintenance manuals.

E. Provide reports in hardback, letter size manuals, complete with an index page, and indexing tabs, with cover identification at front and side.

F. Include detailed procedures, agenda, and sample report forms before commencing system balance.

1.05 QUALITY ASSURANCE

A. The mechanical contractor may at his option perform a hydrostatic pressure test and hydronic balancing of the HVAC piping systems.

B. Air Balance Subcontractor shall be a qualified representative of the Air Distribution Manufacturer whose devices are used on the project or a qualified Independent Balancing Contractor. Air Balance Subcontractor may not be the Mechanical Contractor or the Sheet Metal Contractor on the project.

C. To be considered qualified, the Air Distribution Manufacturer shall include with air device shop drawings evidence of qualifications as follows:
   1. Resume of Air Balance Technician(s) to be used on the project including a list of major air balance projects within the last five (5) years. The minimum acceptable experience shall be three (3) years as Air Balance Technician and five (5) projects similar in size and complexity.
   2. Resume of the firm's experience in air balance and list of air balance projects within the last

five (5) years.
3. Evidence of certification of calibration of equipment.

D. To be considered to be qualified, Independent Air Balance Contractor shall submit evidence of qualifications as follows:
1. Resume of a firm's experience in air balance representing a minimum of two (2) years as an Air Balance Contractor. Resume shall include a list of air balance projects within the last five (5) years.
2. Resume of Air Balance Technicians(s) to be used on the project, including a list of major air balance projects within the last five (5) years. The minimum acceptable experience shall be three (3) years as Air Balance Technician and five (5) projects similar in size and complexity.
3. Evidence of certification of calibration or equipment.

1.06 SEQUENCING AND SCHEDULING

A. Sequence work under the provisions of Division 01.

B. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

C. Schedule and assist in final adjustment and test of life safety, smoke evacuation, and/or smoke control system with Fire Authority.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. All measurements during air balance operations shall be made utilizing the "Velometer" or "Anemometer" method. Instruments used for check of air quantities shall have recent certification of calibration.

B. The Air Balance Subcontractor shall furnish balance forms for all air systems. Forms shall list air distribution devices by location, system, size, pattern, CFM flow factor, and required velocity.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before commencing work, verify that systems are complete and operable. Ensure the following:
1. Equipment is operable and 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. Correct fan rotation.
7. Fire and volume dampers are in place and open.
8. Coil fins have been 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 has been minimized.
12. Hydronic systems have been flushed, filled, and vented.
13. Correct pump rotation.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Report any defects or deficiencies noted during the performance of services to Architect/Engineer.

C. Promptly report abnormal conditions in mechanical systems or conditions which prevent system

balance.

D. If, for design reasons, the system cannot be properly balanced, report as soon as observed.

3.02 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineers to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.03 INSTALLATION TOLERANCES

A. Adjust air handling systems to plus or minus 5 percent for supply systems plus or minus 10 percent for return and exhaust systems from figures indicated.

B. Adjust hydronic systems to plus or minus 10 percent of design conditions indicated.

3.04 ADJUSTING

A. Recorded data shall represent measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other 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 the report. Recheck points or areas as selected and witnessed by the Owner.

3.05 HYDROSTATIC TEST

A. After completion of the installation, all piping shall be tested under 100 psi hydrostatic pressure, which shall be maintained for one hour without loss of pressure; after the system is proven tight and put in service, the contractor shall perform the equipment start-up and operating tests. All equipment shall be placed in complete operating conditions subject to the approval of the Architect.

3.06 AIR BALANCE PROCEDURE

A. All air quantities shall, after completion of the job; be adjusted to provide air quantities shown on plans. After complete adjustment, additional re-adjustment shall be performed if necessary to satisfy the desired temperature.

B. The balance procedure shall include the checking of each supply, return, and exhaust fan. As a minimum, CFM, RPM, and ampere readings shall be taken. Pulley adjustments, etc., shall be performed to obtain the required CFM readings.

C. Air Balance Subcontractor shall also furnish all balancing instruments required. Air Balance Subcontractor shall provide one experienced technician to the team with the Contractor's technician to balance the system. The Air Balance Subcontractor's Technician and the Contractor's Technician shall perform as a team during the entire field balancing operation.

D. After all adjustments and corrections have been performed to balance the system as designed and required, the Air Balance Subcontractor shall prepare and submit three (3) copies of completed balance form to Architect/Engineer for approval.

E. At the time of balancing, the Air Balance Contractor's Technician shall verify that each device is the size and pattern submitted and includes accessories such as volume controls and deflectrols,

where specified.

F. Where the project includes controlled Air Terminal Units, the Terminal Unit Manufacturer's Supplier shall be responsible for testing the automatic control devices on the Terminal.

3.07 WATER BALANCE PROCEDURE

A. With all manual valves in the fully open position and all control valves full flow to coil, adjust pump discharge valves to design flow on pumping systems.

B. Automatic flow control valves will balance flow to coils.

C. Balance flow through pumps at chillers, towers, and boilers.

3.08 SYSTEM OPERATING TEST

A. After the successful completion of all equipment start-up and individual item test requirements, formal tests shall be performed on the complete Mechanical systems, measurements shall be made and reports prepared as specified below. Provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms. Submit for the Architect's approval the form on which the measurements specified herein. Furnish all required record forms.

B. First operating test by Contractor: Prove the operation of the Mechanical systems and of each individual item in the systems. At least 10 days' notice shall be given the Architect of such tests. Should any item of the systems fail to perform in an approved manner, this test shall be repeated until the operating test is approved by the Architect. During this test, balance circulation of steam, condensate, heating and chilled water, air and all other fluids conveyed to provide proper quantities to all items of equipment. Adjust and set all balancing cocks, valves, dampers and similar items to insure that the systems perform as intended.

C. Checking by Owner and Architect: Following the successful completion of first operating tests by the Contractor, the Owner and Architect shall have the privilege of making such tests as they may desire during a period of three weeks to ascertain if any corrections are to be made to the system. At the end of the testing by the Owner and Architect, the Architect shall direct the Contractor in writing to make such corrections to the systems as are within the Scope of the contract.

D. Contractor's corrections to systems: Make all required corrections to the systems and notify the Architect in writing that the corrections outlined have been completed.

E. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the 3-day operating test.
   1. Electrical: Running ampere and voltage of each motor 3/4HP or larger.
   2. Air pressures at the entrance and exit of each electronic air cleaner, filter, coil, fan, and damper.
   3. Air temperatures in each heated or air-conditioned space, at the entrance and exit of each coil, downstream from each pair of dampers where the air of two different temperatures is mixed and outside the structure.
   4. Relative humidity at the location of each humidity sensor.
   5. Domestic hot water supply temperature at the fixtures closest to and farthest away from the domestic water heater on each system.
   6. Running ampere and voltage on recirculating pumps.
   7. The static pressure of cold water line at building service connection (only once during a 3-day test).

G. Report: Four copies of a written report of the operating test, on the approved form of record, shall be submitted to the Architect for approval and subsequent transmittal to the Owner.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Duct Insulation for HVAC Systems.

1.02 RELATED SECTIONS

A. Section 23 31 00 – HVAC Ducts and Casings.

1.03 REFERENCES

A. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

B. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

C. ASTM E96 - Water Vapor Transmission of Materials.

D. NFPA 255 - Surface Burning Characteristics of Building Materials.

E. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

F. Test standards and procedures for evaluating and a rating performance of fire-resistive and zero inch clearance, duct wrap systems.
   1. Underwriters Laboratories Inc., (UL):
      a. UL 723, Surface Burning Characteristics per ASTM E 84.
      b. UL 1978, First Edition of the Standard for Grease Ducts.
      c. UL 1479, Through-Penetration Firestop Test.
   2. American Society for Testing and Materials (ASTM):
      a. E119, Standard Method of Fire Test of Building Construction and Materials; 2-hour External Total Engulfment Test.
      b. E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.
   3. NFPA 96, 1994 Edition, Ventilation Control and Fire Protection of Commercial Cooking Operations.

1.04 SUBMITTALS

A. Submit under provisions of Division 01 and Section 23 05 00.

B. Product Data: Provide product description, list of materials, and thickness for each service, and locations.

C. Manufacturer's Installation Instructions: Indicate procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/100 per NFPA 255.

1.06 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with a minimum of three years- experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 23 05 00.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's density, and thickness.

C. Store insulation in the original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cement.

PART 2 - PRODUCTS

2.01 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553 and C612; flexible, non-combustible blanket.
1. "K" value: 0.27 at 75 °F.
2. Maximum service temperature: 250 °F.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 1.0 lb./cu ft.

B. Vapor Barrier Jacket:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: 0.04 perm.
3. Secure with adhesive and tape.

C. Vapor Barrier Tape
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with a pressure-sensitive rubber-based adhesive.

2.02 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, non-combustible blanket.
1. "K" value: 0.24 at 75 °F.
2. Maximum service temperature: 350 °F.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Density: 4.2 lb./cu ft.

B. Vapor Barrier Jacket:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture vapor transmission: 0.04 perm.
3. Secure with adhesive tape.

C. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with a pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER DUCT LINER, FLEXIBLE

A. Insulation: ASTM C553; flexible, bonded fibers, non-combustible blanket with edge coating.
1. "K" value: 0.26 at 75 °F.
2. Maximum service temperature: 250 °F.
3. Density: 1.5 lb./cu ft.

B. Adhesive:
1. Waterproof, fire-retardant type.

C. Liner Fasteners: Galvanized steel, the impact applied, or welded with a press on head conforming to Mechanical Fastener Standard MF-19/1.

2.04 APPROVED MANUFACTURERS

A. Glass Fiber, Flexible:
1. Owens Corning Fiberglass, Type 100.
2. Architect Approved.

B. Glass Fiber, Rigid:
   1. Owens Corning Fiberglass, Type 704.
   2. Architect Approved.

C. Glass Fiber Duct Liner, Adjustable:
   1. Certainteed Toughgard 150.
   2. Architect Approved.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that ductwork has been tested and joints and seams sealed, before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials per the manufacturer's instructions.

B. Insulated ductwork conveying air below or above ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate the entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Ducts exposed outside the building shall be externally insulated with 2” thick rigid glass fiber insulation, and covered with a “peel and stick” membrane jacket system equal to “Alumguard” (50-60 mil thickness & .3 lbs./sf weight).

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

3.04 FLEXIBLE GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS
All supply, return and outside air ducts inside the building Unless noted otherwise.	2 inches
Dishwasher exhaust duct	2 inches

3.05 RIGID GLASS FIBER DUCTWORK INSULATION SCHEDULE

DUCTWORK	THICKNESS
All ductwork external to the building (See Section 3.02, Paragraph D)	2 inches

3.06 FLEXIBLE GLASS FIBER DUCT LINER INSULATION SCHEDULE

DUCTWORK	THICKNESS
Furnace plenums & ductwork where shown on the drawings.	1 inch

END OF SECTION

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SECTION 23 09 33

ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.01 SCOPE

A. Low voltage electric controls system.

B. Includes:
1. This section includes but is not necessarily limited to the automatic control of heating, ventilating and air conditioning equipment as follows:
   a. Air cooled outdoor heat pump units.
   b. Split system air handling units with coils.
   c. Exhaust fans.
2. Conduit shall be furnished by the Electrical Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 23 05 00 – Common Work Results for Heating, Ventilating and Air Conditioning.

B. Section 23 05 13 – Common Electrical Requirements for HVAC Equipment.

C. Division 26 – All Sections.

1.03 COORDINATION

A. All power and motor and line voltage interlock wiring shall be done by the electrical contractor unless otherwise noted for specific items.

B. The Electrical contractor shall furnish and install all conduit and back boxes for controls and interlock wiring.

C. Low voltage control and interlock wiring shall be done by the Mechanical contractor. Motors shall be as shown on the drawings.

D. The mechanical contractor shall furnish and install any low voltage relays, thermostats and similar items required for the proper operation of the mechanical equipment.

E. The mechanical contractor shall coordinate exact requirements with the Electrical Contractor.

1.04 SUBMITTALS

A. The contractor shall submit complete temperature control diagrams with written "sequence of operation" and factory printed specification data sheets, covering each control device proposed to be used for review prior to installation of any equipment or part of the system. Diagrams shall contain a Bill of Materials list for each device used.

B. Submittals shall show complete piping diagrams (part designations) and terminal-to-terminal wiring diagrams of all control and interlock wiring furnished under this specification.

C. Submittal shall include a schematic one line riser diagram noting conduit sizes and number of conductors contained therein for approval.

1.05 QUALITY ASSURANCE

A. Wiring:
1. The wiring and conduit system for the control and operation of the mechanical system items shall comprise a unitary separate wiring system. The installation of this wiring system shall be governed by Division 26 - ELECTRICAL.
2. Control system wiring shall not be run in conduit installed for power wiring by Division 26 - ELECTRICAL, without direct approval of the Architect.

B. Control system shall consist of all thermostats, temperature sensors, controllers, automatic valves, damper operators, control panels, controls and interlock wiring to fill the intent of the specifications and provide for a complete and operable system.

1.06 INSTRUCTION TO OWNER'S REPRESENTATIVES

A. Upon completion of the work, the contractor shall instruct operating personnel in use and programming of each control system. Owner shall be furnished two (2) copies of reference control system brochure covering equipment control diagrams and sequence of operation, in addition to framed schematics, located where directed by the Architect, of the control system and sequence of operation.

PART 2 - PRODUCTS

2.01 THERMOSTATS

A. Thermostats shall be programmable low voltage.

B. Thermostats shall be two stage heating and cooling, as shown on the plans.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall be responsible for the control and interlock wiring associated with the air conditioning system. Coordinate location, power requirements, conduit runs, etc. with the Electrical Contractor.

B. Furnish and install all low voltage wiring between thermostats and controlled equipment. Number of wires and wire gauge shall be as recommended by the equipment manufacturer for this specific application.

C. Minimum size for line voltage wiring (over 24-volts) shall be No. 14 TW or RH. Minimum size on 24-volt and under wiring shall be No. 16 TW or RH. All wiring shall be in accordance with the National Electrical Code for current carrying capacity.

D. Interlock controls shall be made through auxiliary contacts with pairs of conductors. Cross-phasing or single wire interlocking will not be acceptable.

E. Provide all necessary boxes, fittings and accessories as required.

F. Do not run conduit concealed under insulation or inside ducts. Mount control devices and conduit located on ducts or apparatus with external insulation on stand-off support to avoid interference with insulation.

G. Run wire connecting devices on or in control cabinet parallel with the sides of the cabinet

neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect wires from sharp edges of panels, conduit and other items.

3.02 SEQUENCE OF OPERATION

A. Refer to plans for sequences of operation.

END OF SECTION

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SECTION 23 23 00

REFRIGERANT AND CONDENSATE PIPING

PART 1 - GENERAL

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

1.02 SCOPE

A. Interconnecting piping between evaporator-coil and condensing unit on split system packaged units.

B. Equipment condensate drains.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 07 19 – HVAC Piping Insulation.

PART 2 – PRODUCTS

2.01 PIPING

A. Type "L", hard drawn copper (degreased) – refrigerant piping.

B. Type “M” hard drawn copper – condensate drains

2.02 FITTINGS

A. Wrought copper.

2.03 SOLDER

A. Brazing alloy with 1000 °F melting point and suitable flux.

2.04 VALVES

A. Pack-less bellows or diaphragm type for use with Freon type refrigerant.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper tubing: ASTM B88, Type M, hard drawn.
   1. Fittings: ANSI/ASME B16.23 cast brass, or ANSI/ASME B16.92 solder wrought copper.
   2. Joint: ASTM B32 solder, Grade 95TA.

2.06 APPROVED MANUFACTURERS

A. Valves:
   1. Mueller Brass Company.
   2. Architect approved equal.

B. Solder:
   1. Phoson Fifteen.
   2. Architect approved equal.

PART 3 – EXECUTION

3.01 Install refrigerant accessories as shown on the drawings and as may be recommended by the unit manufacturer.

3.02 Provide double suction risers and pitch lines as required to ensure positive oil return to the compressor.

3.03 Testing shall be done during the progress of work or at completion to ensure a tight system. Change the system with dry nitrogen and soap test hot gas lines at 300 psi and liquid and suction lines at 245 psi. Allow the system to stand for 24 hours under pressure and if a change in pressure, the system may be considered tight.

3.04 Before charging, evacuate the system to 0.15 inches of mercury absolute pressure. All pumps to operate at least four (4) hours at this reading.

3.05 REFRIGERANT CONTAINMENT

A. The contractor shall take all necessary precautions to prevent the accidental or intentional release of refrigerant to the atmosphere.

B. When a sealed system must be broken, provide all necessary equipment and containers as required to pump down the entire system volume, or that volume not contained in isolated receivers on the equipment.

C. The contractor shall clean and re-use refrigerant to the greatest extent possible. Un-used refrigerant shall be properly disposed of or recycled at the Contractor's expense.

3.06 Provide proper charge of refrigerant and oil for proper operation per manufacturer requirements.

3.07 Condensate drains for furnaces and cooling coils shall be combined and routed to floor drains, or as indicated on the drawings. Route piping, as required to not block access to the unit.

3.08 Insulate all condensate drain piping inside the building.

3.09 Condensate drains from outdoor packaged units mounted on concrete pads shall be piped to the edge of the slab in a manner as to not impede access to the unit.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for HVAC Ducts and Casings.

1.02 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 07 13 – Duct Insulation.

D. Section 23 05 93 – Testing, Adjusting, and Balancing.

1.03 QUALITY ASSURANCE

A. Installer: A firm with at least 3-years of successful installation experience on projects with low-pressure ductwork systems work, similar to that required for the project.

B. SMACNA Standards: Comply with SMACNA HVAC Duct Construction Standards for fabrication and installation of low-pressure ductwork.

C. NFPA Compliance: Comply with ANSI/NFPA 9OA Standard for the Installation of Air-Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems" and ANSI/NFPA96 "Standard for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment".

D. Field Reference Manual: Have available at the project field office, copy of "SMACNA HVAC Duct Construction Standards", latest Edition.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork, used for work of this section.

B. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets, per requirements of Division 01.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect shop-fabricated and factory-fabricated ductwork, accessories, and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 LOW-PRESSURE DUCTWORK

A. Fabricate and support per SMACNA HVAC Metal Duct Standard and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts per ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

C. Construct T's, bends, and elbows with the radius of not less than 1-1/2 times the width of the duct on the centerline. Where not possible and where rectangular elbows are used, provide turning vanes.

D. Increase duct sizes gradually, not exceeding 15 ° divergence wherever possible. Divergence upstream of equipment shall not exceed 30 °; convergence downstream shall not exceed 45 °.

E. Provide easements where low-pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.

F. Use double nuts and lock washers on threaded rod supports.

G. Provide “paint grip” finish where indicated on drawings.

2.02 FLEXIBLE DUCT CONNECTOR

A. Flexible duct connectors shall be of two-element spiral construction composed of a corrosion-resistant metal supporting spiral and a coated fabric with a mineral base.

B. Flexible duct connectors shall be listed by UL and shall have a flame spread rating not exceeding 25 and a smoke-developed rating not exceeding 30.

C. Lengths shall not exceed 24 inches unless shown otherwise and shall be the same as spiral run-out or box inlet, whichever is larger.

2.03 SINGLE WALL DUCT AND FITTINGS

A. Round and oval ductwork shall be 26-gauge galvanized steel minimum, spiral locked seam pipe.

B. Fittings shall be machine formed fittings as manufactured by the duct manufacturer. Fittings shall match those shown on the drawings as closely as possible. All fittings shall have a turning radius of 1-1/2 times the diameter of the duct where possible.

2.04 EXTERIOR DUCTWORK

A. Supply ductwork on the exterior shall be dual-wall duct herein specified, except insulation thickness shall be 3 inches and ductwork shall be built and installed for exterior application with aluminum cover.

B. Joints shall be bolted circular type with seals for 8-inch static pressure.

C. The exterior shall have a prime coat for the field finish coat.

2.05 DRYER VENT

A. Dryer vent duct shall have smooth interior finish with joints running in direction of airflow.

B. Dryer vents shall not be assembled with sheet metal screws or other means which extend into the duct. Seal each joint with non-combustible material.

C. Provide vent cap with backdraft damper and no screen. See detail on plans.

D. Provide Complete UL listed kit with everything needed to connect the dryer to wall vent:
- Close fit for 4-in wall clearance.
- 6-ft of flexible pipe.
- 2 close elbows resist crushing and maintain airflow.
- Swivel cuffs on close elbows allow moving dryer without disconnecting.
- Conforms to UL safety requirements.

2.06 APPROVED MANUFACTURERS

A. Semco (single wall and dual wall ductwork).

B. Wire-Mold (Type 57 flexible ductwork).

C. Architect Approved.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Provide openings in ductwork that were required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with a metal cap with spring device or screw to insure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

C. Connect diffusers or troffer boots to low-pressure ducts with 3 feet maximum length of flexible duct. Hold in place with a strap or clamp.

D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Seal all traverse joints and longitudinal seams in all ductwork with Hard-cast sealant.

F. Clean the duct system and force air at high velocity through a 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.

3.02 INSTALLATION (LOW PRESSURE DUCTWORK)

A. Straight and smooth on inside with joints neatly finished unless otherwise directed.

B. Duct panels through a 48-inch dimension having acoustic duct liner need not be cross-broken or beaded.

C. Cross-break all unlined duct and lined duct panels larger than 48 inches or bead 12 inches on center.

D. Securely anchor ducts to building structure with specified duct hangers attached with screws.

E. Brace and install ducts so they shall be free of vibration under all conditions of operation.

F. Ducts shall not bear on the top of structural members.

G. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on drawings.

H. Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions shown on drawings are actual sheet metal sizes.

I. Properly flash where ducts penetrate above the roof.

J. Install internal ends of slip joints in direction of flow. Make joints airtight using a mastic type duct sealer.

K. Cover horizontal and longitudinal joints on the exterior of ducts with two (2) layers of Hard-cast tape installed with Hard-cast, HC-20 adhesive according to manufacturer's recommendations.

L. All longitudinal seams shall be Pittsburgh Lock seams. All ductwork shall be strengthened by diamond crimping of the sheets.

M. All elbows shall have a throat radius equal to the width of the duct wherever possible. Air Turns, as manufactured by Tuttle & Bailey, Inc., or approved locally made vanes, shall be installed in all square elbows. Horizontal ducts over 400 square inches in cross-sectional area shall be supported from overhead structure members by 3/4 inch x 1/8 inch strap iron. Horizontal ducts, under 400 square inches in cross-sectional area shall be supported from an overhead structure

with the use of 1 inch wide 18-gauge galvanized metal straps.

3.03 DUCT SEALS

A. All-round ductwork shall be either welded or joint shall be sealed with duct sealer, sheet metal screws, and duct tape. The sealing procedure shall be as follows:
   1. Apply duct sealer to fittings and slip fitting or coupling into a duct.
   2. Install sheet metal screws at 8 inches on centers as close to fitting head as possible with a minimum of three (3) screws per fitting.
   3. Apply a layer of sealer to the outside of the joint, approximately 2-1/2 inches wide. Make sure that sheet metal screw heads are completely covered, as well as joint and coupling head.
   4. Apply a single pass of duct tape over the wet sealer. Pull tight and smooth to make complete contact.

3.04 Exterior supply duct shall be covered with 14 gauge sheet metal cover for top 200 **°** of duct circumference with drip rim on each side. Provide a prime coat for the field finish coat.

3.05. Paint ductwork visible through registers, grilles, and diffusers flat black.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Air Duct Accessories for complete Heating, Ventilating, and Air Conditioning Systems.

1.02 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning Controls.

B. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 31 00 – HVAC Ducts and Casings.

D. Section 23 05 93 – Testing, Adjusting, and Balancing.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacturer of duct accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) high pressure and low-pressure duct construction standards.

C. Industry Standards: Comply with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations of construction of duct accessories, except as otherwise indicated.

D. UL Compliance: Construct, test, and label fire dampers per Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".

E. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 9OA "Air Conditioning and Ventilating Systems", of installation of duct accessories.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of duct construction; and installation instructions.

B. Shop Drawings: Submit assembly-type shop drawings for each type of duct assembly showing interfacing requirements with ductwork and method of fastening or support.

C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.01 DAMPERS

A. Low-Pressure Manual Dampers: Provide dampers of single blade type of multi-blade type, constructed per SMACNA "Low-Pressure Duct Standards".

B. Control Dampers: Refer to Division 23 section "Temperature Control Systems" for control dampers; not work of this section.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include, but are not limited to, the following:

Air Balance, Inc.
Airguide Corp.
Airstream Products Div., Penn Ventilator Co., Inc
American Warming & Ventilating, Inc.
Arrow Louver and Damper Corp
Elgo Shutter and Mfg. Co
Imperial Damper and Louver Co., Inc
Louvers & Dampers
Ruskin Mfg. Co.

2.02 FIRE AND SMOKE DAMPERS

A. Fire Dampers: Provide fire dampers, of types and sizes, indicated. Construct casings of 11 gauge galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160-165 °F (71-74 °C) unless otherwise indicated. Provide damper with positive lock in a closed position, and with the following additional features:
   1. Damper Blade Assembly: Single-blade type (ducts less than 10 inches deep).
   2. Damper Blade Assembly: Curtain type.
   3. Blade Material: Steel, match casing.

B. Motor-Driven Smoke Dampers: Provide smoke damper, resettable type linkage of sizes indicated, designed and constructed per NFPA-9OA, motor operated, frame constructed of 10-gauge galvanized steel with provisions for securing to building and attaching to ducts, electric motor operator, casing to have a bonded red acrylic enamel finish, low leakage with friction-free metal seals, 32" long wire leads for connecting to smoke detector, and the following additional features:
   1. Damper Blade Assembly: Single-blade type (ducts less than 10 inches deep).
   2. Damper Blade Assembly: Multi-blade type.
   3. Blade Material: Steel, matching casing.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include, but are not limited to, the following:
Air Balance, Inc.
Airstream Products Div., Penn Ventilator Co, Inc
American Warming & Ventilating, Inc.
Arrow Louver and Damper Corp
Louvers & Dampers
Phillips-Aire
Ruskin Mfg. Co.

2.03 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed per SMACNA "Low-Pressure Duct Standards".

B. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2 inch wide curved blades set at 1-1/2 inch o.c., supported with bars perpendicular to blades set at 2 inches o.c., and set into side strips suitable for mounting in ductwork, per SMACNA Standards for low-pressure duct.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include, but are not limited to, the following:
Air Filter Corp.
Anemostat Products Div., Dynamics Corp. of America
Duro-Dyne Corp.
Environmental Elements Corp., Subs. Koppers Co., Inc.
Tuttle & Bailey Div. of Interpace Corp.

2.04 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on a project, for the following:
   1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of the shaft; and end bearing plate on another end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include, but are not limited to, the following:
   Ventfabrics, Inc.
   Young Regulator Co.

2.05 DUCT ACCESS DOORS

A. General: Provide, where indicated and at all fire and smoke dampers, duct access doors of the size indicated.

B. Construction: Construct of same or greater gage as ductwork served, provide double panel insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, another side with 1 handle-type latch for doors 12 inches high and smaller, 2 handle-type latches for larger doors.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include, but are not limited to, the following:
   Air Balance Inc.
   Duro Dyne Corp.
   Register & Grille Mfg. Co., Inc.
   Ruskin Mfg. Co.
   Semco
   Ventfabrics, Inc.
   Zurn Industries, Inc., Air Systems Div.

2.06 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.07 DUCT ACCESS DOOR/PRESSURE RELIEF DOOR

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install duct accessories per manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and per recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90 ° elbows in supply.

C. Install access doors to open against system air pressure, with latches operable from either side,

except outside only where the duct is too small for a person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while the system is operating. Repair or replace faulty accessories as required to obtain proper operation and leak-proof performance.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: HVAC Power Ventilators
   1. 23 00 00 Heating, Ventilating, and Air-Conditioning (HVAC)
   2. 26 00 00 Electrical

1.02 REFERENCES

A. Air Movement and Control Association Inc. (AMCA):
   1. 99 - Standards Handbook
   2. 200 - Publication, Air Systems
   3. 201-90 - Publication, Fans, and Systems
   4. 202-88 - Publication, Troubleshooting
   5. 203-90 - Publication, Field Performance Measurement of Fan Systems
   6. 211-05 - Publication, Certified Ratings Program – Product Rating Manual for Fan Air Performance
   7. 300-96 - Standard Reverberant Room Method for Sound Testing of Fans
   8. 311-05 - Publication Certified Rating Program – Product Rating Manual for Fan Sound Performance
   9. 99-0401-86 - Classification for Spark Resistant Construction
   10. 99-2408-69 - Operating Limits for Centrifugal Fans

B. Air Movement and Control Association Inc. (AMCA), American National Standards Institute (ANSI):
   1. 204-05 - Standard Balance Quality and Vibration Levels for Fans
   2. 210-99 - Standard Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

C. American Society of Civil Engineers (ASCE):
   1. 7-02 - Minimum Design Loads for Building and Other Structures

D. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
   1. Chapter 45 - 2003 handbook, HVAC Applications
   2. Chapter 7 - 2001 Fundamentals handbook, Sound-Vibration
   3. Chapter 32 - 2001 Fundamentals handbook, Duct Design
   4. Chapter 18 - 1992 HVAC System and Equipment handbook, Fans

E. National Fire Protection Association (NFPA)
   1. 70 - National Electrical Code
   2. 90A-02 - Standard for the Installation of Air-Conditioning and Ventilating Systems
   3. 92A-06 - Recommend Practice for Smoke-Control System
   4. 92B-05 - Standard for Smoke Management System in Malls, Atria, and Large Areas
   5. 96-04 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

F. Occupational Safety and Health Administration (OSHA):
   1. 1910.212 - General requirements for Machine Guarding
   2. 1910.219 - General requirements for guarding safe use of mechanical power transmission apparatus
   3. 1926.300 - General requirements for safe operation and maintenance of hand and power tools

G. Underwriters Laboratories (UL):
   1. 507 - Electric Fans
   2. 555 - Fire Dampers
   3. 555S - Smoke Dampers
   4. 705 - Standard Power Ventilators
   5. 762 - Standard Power Roof Ventilators for Restaurant Exhaust Appliances
   6. 793 - Snow Load

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01 3300 Submittal Procedures

B. Provide dimensional drawings and product data on each fan.

C. Provide fan curves for each fan at the specified operation point, with the flow, static pressure, and horsepower clearly plotted.

D. Provide outlet velocity and fan's inlet sound power readings for the eight-octave bands, decibels, and sones.

E. Strictly adhere to QUALITY ASSURANCE requirements as stated in section 1.04 of this specification.

F. Provide manufacturer's certification that exhaust fans are licensed to bear Air Movement and Control Association (AMCA), Certified Rating Seal for sound and air performance.

G. Installation, Operation, and Maintenance Manual (IOM): Provide manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, and safety information and cleaning. A troubleshooting guide, parts list, warranty, and electrical wiring diagrams.

1.04 QUALITY ASSURANCE

A. Performance ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal.

B. Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99

C. Each fan shall be given a balancing analysis that is applied to wheels at the outside radius. The maximum allowable static and dynamic imbalance is 0.05 ounces (Balance grade of G6.3).

D. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

E. The High Wind models have been analyzed and stamped by a state license P.E. to the ASCE 7-02 Standard which meets the IBC, Florida, and Miami-Dade codes.

F. Each High Wind model is subject to be certified by a third party to the ASTM E330 Static Pressure Difference Standard.

G. All High Wind models have been analyzed using Computational Fluid Dynamics (CFD). The CFD simulates the flow of high speed (150MPH) winds over the surface of objects.

H. The Finite Element Analysis (FEA) is the result of the CFD and it can accurately predict the stress, strain, and deflection resulting from high wind loads.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.

B. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with the manufacturer's instructions. For the long term, storage follows the manufacturer's Installation, Operations, and Maintenance Manual.

C. Handling: Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer

1.06 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by an authorized company official. The manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under Contract Documents.
   1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts that prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.
   2. Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished by us prove defective during this period, they should be returned to the nearest authorized motor service station.

1.07 MAINTENANCE

A. Refer to Manufacturer's Installation, Operation, and Maintenance Manual (IOM), to find maintenance procedures.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Cook

B. Greenheck

C. Architect Approved

2.02 DIRECT DRIVE CEILING MOUNTED CENTRIFUGAL EXHAUST FANS

A. General Description:
   1. Base fan performance at standard conditions (density 0.075 Lb./ft3)
   2. Ceiling mounted applications
   3. Performance capabilities up to 200 cubic feet per minute (cfm) and static pressure to 0.75 inches of water gauge
   4. Fans are available in nineteen sizes (50 - 200 unit sizes)
   5. Maximum operating temperatures is 130 °F (54.4 °C)
   6. Sound levels as low as 1.7 AMCA sones
   7. UL/cUL listed for above bathtub exhaust
   8. Fans are UL/cUL listed 507 - Electric Fans
   9. Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

B. Wheel:
   1. Forward curved centrifugal wheel
   2. Constructed of calcium carbonate filled polypropylene
   3. Statically and dynamically balanced in accordance with AMCA Standard 204-05

C. Motors:
   1. Motor enclosures shall be open drip-proof (ODP), opening in the frame body and or end brackets
   2. Motors are permanently lubricated sleeve bearing type to match with the fan load and furnished at the specified voltage and phase
   3. Motors shall be mounted on vibration isolators and be accessible for maintenance
   4. Compatible for use with speed controls
   5. Thermal overload protection

D. Housing:
   1. Constructed of heavy gauge galvanized steel
   2. Profile as low as 6 15/16 inches

E. Aluminum Backdraft Damper:
   1. Prevents air from entering back into the building when the fan is off
   2. Eliminates rattling or unwanted backdrafts

F. Outlet:
   1. Steel duct collar shall be six or four inches in diameter to accept a six or four-inch round ductwork.
   2. Shall include a backdraft damper

G. Grille:
   1. Types: Provide optional aluminum grille.
   2. Constructed of high impact polystyrene plastic shall be factory standard on all units. (Not for this Project.)
   3. Attached to the housing with screws

H. Mounting Brackets:
   1. Fully adjustable for multiple installation conditions

I. Options/Accessories:
   1. Disconnect Switches:
      a. NEMA rated: 1
      b. Positive electrical shut-off
      c. Access for wiring shall be external
   2. Grille Filter:
      a. Washable aluminum mesh filter that goes between fan and grille
      b. Reduces sound levels
      c. Traps dirt before entering the fan.
   3. Speed Controls:
      a. Controls the fan’s output
      b. The fan can be adjusted to 60 percent of full speed
      c. Can be used to operate more than one fan at a time
   4. Vibration Kit:
      a. Available for suspended installations
      b. Includes a pre-punched hole for ease of installation and shall have all hardware to mount one unit.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

3.02 EXAMINATION

A. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected

3.03 PREPARATION

A. Ensure roof openings are square, accurately aligned, correctly located, and intolerance

B. Ensure the duct is plumb, sized correctly, and to proper elevation above the roof deck. Install duct as specified in Air Distribution (Division 23)

3.04 INSTALLATION

A. Install fans system as indicated on the Installation, Operation, and Maintenance Manual (IOM) and contract drawings

B. Install fans in accordance with manufacturer's instructions

3.05 SYSTEM STARTUP

A. Refer to Installation, Operation, and Maintenance Manual (IOM)

3.06 ADJUSTING

A. Adjust exhaust fans to function properly

B. Adjust Belt Tension

C. Lubricate bearings

D. Adjust drive for final system balancing

E. Check wheel overlap

3.07 CLEANING

A. Clean as recommended by the manufacturer. Do not use material or methods which may damage finish surface or surrounding construction

3.08 PROTECTION

A. Protect installed product and finished surfaces from damage during construction

B. Protect installed exhaust fans to ensure that, except for normal weathering, fans will be without damage or deterioration at time of substantial completion

END OF SECTION

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SECTION 23 37 00

AIR INLETS AND OUTLETS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Basic Requirements for Air Inlets and Outlets.

1.02 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for Heating, Ventilating, and Air Conditioning System.

B. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 31 00 – HVAC Ducts and Casings.

D. Section 23 05 93 – Testing, Adjusting, and Balancing.

1.03 REFERENCES

A. ADC 1062 - Certification, Rating, and Test Manual.

B. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

C. ARI 650 - Air Outlets and Inlets.

D. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

E. SMACNA - Low-Pressure Duct Construction Standard.

1.04 QUALITY ASSURANCE

A. Test and rate performance of air outlets and inlets per ADC Equipment Test Code 1062 and ASHRAE 70.

B. Air distribution devices have been specifically selected based on the specified manufacturer's performance data. If the Contractor submits on devices other than those specified the submittal must include an item by item selection of substitutions listed by space location.

C. Where compliance with performance requires different dimensions, such as neck or face size than the specified item, the submittal must note where these dimension changes occur listing both the original and the new dimensions.

D. Any additional costs by any trade resultant from air device substitution shall be borne by the Contractor.

1.05 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.

1.06 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 23 05 00.

B. Submit a schedule of air devices indicating type, size, location, and application.

C. The schedule must include model number, size, air pattern, CFM, pressure drop, throw NC noise level, finish, and mounting method for both the submitted and a specified device.

D. Review requirements of outlets and inlets as to size, finish, and type of mounting before submitting product data and schedules of outlets and inlets.

E. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 AIR DEVICES

A. All air devices shall be equal to products scheduled on the Drawings.

2.02 LOUVERS (ALUMINUM)

A. Frame shall be a 6-inch deep channel of .081 inch thick 6063-T5 extruded aluminum alloy.

B. Blades shall be constructed of .081 inch thick aluminum. Blades shall be adjustable and drainable.

C. Insect screen shall be aluminum mesh, removable type. The screen shall be mounted on the exterior of the louver.

D. Finish shall be as selected by Architect.

2.03 APPROVED MANUFACTURERS

A. Air Devices
   1. Tuttle & Bailey.
   2. Price
   3. Metal Aire
   4. Architect Approved.

B. Louvers
   1. American Warming and Ventilating LE-31.
   2. Ruskin.
   3. Architect Approved.

PART 3 - EXECUTION

3.01 INSTALLATION (AIR DEVICES)

A. Install air devices per the manufacturer’s instructions.

B. Check the location of air devices and make necessary adjustments in position to conform to architectural reflected ceiling plan, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with the airtight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Provide mounting frame or additional ceiling grid tees as required to mount air devices. Support devices as required to prevent ceiling sag.

3.02 INSTALLATION (LOUVERS)

A. Locate and place louver units, plumb, level, and in proper alignment with adjacent work.

B. Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws were required to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joints fillers, as indicated.

D. Repair finishes damaged by installation operations. Restore finishes so that there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make the required alterations and refinish the entire unit, or provide a new unit, at the contractor's option.

E. Protection non-ferrous metal surfaces from corrosion or galvanic action by application of a

heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

F. Provide concealed gaskets, flashings, joint fillers, and insulations, and install as work progresses to make the installations weathertight.

G. Refer to Division 7, Section 07 900, for sealants in connection with the installation of louvers.

H. Field verified exact opening dimensions and coordinate mounting requirements with General Contractor.

END OF SECTION

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SECTION 23 62 13

AIR COOLED OUTDOOR HEAT PUMP UNITS

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. Outdoor-mounted, air-cooled, split-system heat pump unit suitable for ground or rooftop installation. Unit consists of a hermetic compressor, composite basepan, an air-cooled coil, propeller type condenser fan, suction and liquid line service valve, and a control box. Unit will discharge supply air upward as shown on contract drawings. Unit will be used in a refrigeration circuit to match up to a coil unit.

1.02 QUALITY ASSURANCE

A. Unit will be rated in accordance with the latest edition of AHRI Standard 210.

B. Unit will be certified for capacity and efficiency, and listed in the latest AHRI directory.

C. Unit construction will comply with latest edition of ANSI/ ASHRAE and with NEC.

D. Unit will be constructed in accordance with UL standards and will carry the UL label of approval.

E. Unit will have c-UL-us approval.

F. Unit cabinet will be capable of withstanding ASTM B117 1000- hr salt spray test.

G. Air-cooled condenser coils will be leak tested at 150 psig and pressure tested at 550 psig.

H. Unit constructed in ISO9001 approved facility.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Unit will be shipped as single package only and is stored and handled per unit manufacturer’s recommendations.

1.04 WARRANTY

A. The Contractor shall warranty all material and workmanship for (1) one year from date of substantial completion.

B. Manufacturers standard parts and compressor warranty.

PART 2 - PRODUCTS

2.01 SUMMARY

A. The contractor shall furnish and install split system heat pumps as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS
1. Trane.
2. Lennox.
3. Daikin.
4. Architect Approved.

2.02 GENERAL DESCRIPTION

A. Factory assembled, single piece, air-cooled heat pump unit. Contained within the unit enclosure is all factory wiring, piping, controls, compressor, refrigerant Charge R-410A, and special features required prior to field start-up.

2.03 UNIT CABINET

A. Unit casing is to be constructed of heavy gauge, G60 galvanized steel and painted with a weather-resistant powder paint on all louvers and panels.

B. Unit to include a corrosion and weatherproof CMBP-G30 DuraTuff™ base.

2.04 COMPRESSOR

A. The Climatuff® 2-stage compressor features internal over temperature and pressure protection and hermetic motor. Other features include: centrifugal oil pump and modular plugs for electrical connections.

2.05 CONDENSER COIL

A. The outdoor coil provides low airflow resistance and efficient heat transfer. The coil is protected on all four sides by louvered panels.

2.06 REFRIGERATION CONTROLS

A. Refrigeration system controls include condenser fan, compressor contactor and high pressure switch. High and low pressure controls are inherent to the compressor. A factory installed liquid line drier is standard.

B. As manufactured, this unit has a cooling capability to 55°F.

2.07 ELECTRICAL REQUIREMENTS

A. Unit electrical power will be single point connection.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service.

C. Install units on vibration isolation.

D. Install units on concrete base as indicated.

E. Provide connection to refrigeration piping system and evaporators.

F. Install refrigerant piping per manufacturer’s instructions.

3.02 MANUFACTURER'S FIELD SERVICES

A. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.

END OF SECTION

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SECTION 23 81 27

SPLIT SYSTEM AIR HANDLING UNITS WITH COILS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Packaged air handling units.

1.02 RELATED WORK

A. Section 23 05 48 - Vibration Isolation and Seismic Controls for HVAC Systems.

B. Section 23 07 13 - Ductwork Insulation for HVAC.

C. Section 23 09 33 – Electric and Electronic Control System for HVAC

D. Section 23 31 00 – HVAC Ducts and Casings.

E. Section 23 33 00 – Air Duct Accessories.

F. Section 23 62 13 – Air Cooled Outdoor Heat Pump Units.

1.03 REFERENCES

A. ANSI/UL 883 - Safety Standards for Fan Coil Units and Room Fan Heater Units

B. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

C. ANSI/UL 465/559 - Central Cooling Air Conditioners and Heat Pumps.

1.04 QUALITY ASSURANCE

A. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

1.05 SUBMITTALS

A. Submit drawings indicating assembly, unit dimensions and weights, required clearances, construction details, and field connection details.

B. Submit product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and finishes of materials.

C. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature for start-up instructions, installation instructions, and maintenance procedures.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.08 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.

1.07 WARRANTY

A. Provide one year parts warranty.

PART 2 - PRODUCTS

2.01 SUMMARY

A. The contractor shall furnish and install air handling units(s) as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS
1. Trane.
2. Lennox.
3. Daikin.
4. Architect Approved.

2.02 GENERAL

A. Provide indoor-mounted, packaged air handling unit(s). Unit(s) shall be factory assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

2.03 CASING

A. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned and finished with a baked enamel finish.

B. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.

2.04 FANS

A. Provide fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or roller bearings with permanent lubrication fittings.

C. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels.

D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. Provide cast iron or steel variable and adjustable pitched sheaves, dynamically balanced, bored to fit shafts and keyed.

2.05 COILS

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil. Enclose coils with headers and return bends fully contained within casing.

Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.

B. Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.

2.06 MOTORS

A. For additional static requirements, Variable Speed EC motors to meet and exceed a wide range of airflow needs.

2.07 FILTERS

A. Optional external filter rack shall be provided to accommodate 1” or 2” pleated media filters.
   1. Filters shall be accessible from the front of the air handler through a hinged access door.

2.08 CONTROLS

A. Provide factory installed and wired controls including fan contactor, transformer, low voltage terminal strip and single point power entry provision for electric heat.

B. Provide factory installed FROSTAT to prevent coil freezing at low evaporator temperatures.

C. Provide 7-day programmable thermostat.

2.09 ELECTRIC HEATING COILS

A. Provide electric heat coils constructed of heavy-duty nickel chromium elements with pilot duty or automatic line break high limit controls.
B. Coils shall be UL listed and installed in insulated sheet metal enclosure for installation on fan discharge. Factory supplied and field installed.
C. Polarized plug shall be provided for making electrical connections to the air handler control box from the supplementary heater.
D. Heater kit to include circuit breakers which meet UL requirements for service disconnect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install unit on vibration isolators.

C. Secure unit as required for seismic control.

END OF SECTION

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SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.02 REFERENCES

A. The following specifications and standards of issues listed below but referred to thereafter by basic designation only, form a part of these specifications:
   1. American Society for Testing Materials.
   2. American Standards Association.
   3. Americans with Disabilities Act (ADA).
   4. Arkansas Energy Code (ASHRAE 90.1).
   5. Arkansas Fire Prevention Code.
   6. Illuminating Engineering Society.
   7. Institute of Electrical and Electronic Engineers.
   8. International Building Code, 2012 Edition.
   9. Local, City and State Codes and Ordinances.
   10. National Electrical Code, 2017 Edition.
   11. National Electrical Manufacturers Association.
   12. National Electrical Safety Code, 2002 Edition.
   13. National Fire Protection Association's Recommended Practices.
   14. Occupational Safety and Health Act.
   15. Power Cable Engineers Association.
   16. Service requirements of serving utility company.
   17. Underwriter's Laboratories, Inc.

1.03 SUBMITTALS

A. Submit six (6) sets of shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. The basic information for each item of equipment to be included is as follows:
   1. Index.
   2. Installation and Operating Instructions
      a. Individual tabbed sections.
      b. Manufacturer descriptive literature.
      c. Applicable control diagrams.
      d. Composite wiring diagrams.
   3. Each submittal sheet shall be clearly marked with equipment Catalog Number and accessory items being submitted.

1.04 REGULATORY REQUIREMENTS

A. Work shall conform to all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may at his option propose any article, approved equal to or better than that specified, as approved in writing by the Engineer.

C. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

D. In case of difference between building codes, specifications, state laws, local ordinances, industry standards, and utility company regulations and the contract documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.

E. Non-Compliance: Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

F. All required fees, permits and inspections shall be obtained and paid for by the contractor under the section of the specifications for which they are required.

1.05 ELECTRICAL LICENSE REQUIREMENT

A. No person shall perform electrical work on the Contract without possessing an Arkansas State Master or Journeyman License from the Arkansas State Electrical Examiner's Board. All electrical work and apprentice electricians shall be supervised by a Master or Journeyman Electrician on a one to one ratio.

B. All electricians shall have a copy of their license with them and shall be required to show it to an appropriate inspector upon request.

C. The Arkansas Department of Labor requires that the worker, who installs raceway for low voltage cables of temperature controls, fire alarm, telecommunications, intrusion detection, access control, public address, television distribution, etc., be paid the electrician’s minimum wage rate.

1.06 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. The Engineer/Owner reserves the right to relocate any device a maximum distance of 6'-0" at the time of installation without an extra cost being incurred.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

1.07 CONTRACTOR REVISED DRAWINGS

A. The Contractor shall, during the progress of the work, keep an accurate record of all changes and corrections from the layouts shown on the drawings. Record of changes may be kept by accurately making all changes on a set of prints during the progress of the job.

B. Upon completion of the work and prior to final payment, the Contractor shall furnish to the Engineer, one set of "contractor revised" reproducibles, legibly and accurately marked to indicate all changes, additions, deletions, etc., from the contract drawings.

1.08 GUARANTEE

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the electrical systems under guarantees outlined above for a period of one (1) year.

1.09 OPERATING AND MAINTENANCE MANUALS

A. After approval of materials and equipment for use in this project, 3 copies of an Operation and

Maintenance Manual shall be submitted for approval.

B. The basic information for each item of equipment to be included is as follows:
   1. Index
   2. Maintenance and operating instructions
      a. Manufacturer's descriptive literature and maintenance manuals
      b. An Approved Set of Shop drawings
      c. Applicable control diagrams
      d. Composite wiring diagrams as applicable showing all motor controllers, relays, etc., with interlocking provisions as built in the job, along with a written description of the control sequence if applicable.
      e. Spare parts list (when parts are provided)
      f. Listing of part suppliers and their addresses
      g. Single line diagram of the "as built" building electrical distribution system.

C. Upon final approval, submit one (1) bound copy of the approved Operation and Maintenance Manual to the Engineer and hold two (2) copies for instruction of Owner as hereinafter specified.

1.10 CONFLICTS BETWEEN DRAWINGS AND SPECIFICATIONS

A. If a conflict between the drawings and the specifications occur, the most stringent requirement shall apply.

PART 2 - PRODUCTS

2.01 UL LISTING

A. Where the Underwriter's Laboratories have an applicable standard, the product shall be listed with UL and shall be so marked.

2.02 SUBSTITUTIONS

A. Each Section of the Project Manual, when applicable has a paragraph entitled “Manufacturers”. If “Engineer Approved Equal” is not in the list of manufacturers, no substitutions will be accepted. Submit one of the manufacturers listed.

B. The Engineer does not give any prior approvals on submittals. Do not call the Engineer for prior approval.

PART 3 - EXECUTION

3.01 600 VOLT INSULATION TEST

A. Prior to energizing the electrical system the contractor shall provide insulation resistance tests for all distribution and utilization equipment. The Contractor shall provide a suitable and stable source of test power. The insulation test shall be a "megger" test at 500 volts D.C. for one-half minute. A test report shall be submitted to the Engineer. The minimum insulation resistance for No. 12 AWG conductors shall be 1,000,000 ohms and for larger conductors shall be 250,000 ohms. Conductors testing below the minimum insulation resistance shall be replaced and tested again.

3.02 CONTINUITY TEST

A. The Contractor shall perform a continuity test on the entire electrical system prior to energizing the system to insure proper cable connections.

3.03 CONNECTION TORQUE TESTS

A. All No. 1/0 AWG and larger conductors with bolted connections shall be torque tested using a torque wrench. Torque shall be to National Electrical Testing Association's (NETA) Standards.

3.04 REMOVAL OF RUBBISH

A. Contractor shall remove his rubbish from building site at intervals and shall maintain the spaces allotted him in an orderly manner. On completing his work, and prior to submission of final estimate, he shall remove all tools, appliances, material and rubbish from the grounds.

3.05 GROUND RESISTANCE MEASUREMENTS

A. Ground resistance measurements of each ground rod shall be taken and certified by the Contractor to the Engineer. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and grounding system and submission of test results to the Engineer. Test reports shall indicate the location of the ground rod and grounding system and the resistance and the soil conditions at the time the test was performed. When the building water service is used as a ground of part of the grounding system, ground-resistance measurements shall also be made of this connection. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE No. 142. Submit test reports with Operation and Maintenance Manuals.

3.06 MECHANICAL OPERATION TESTS

A. All electrical equipment, such as switches, circuit breakers, etc., shall be tested by operating the device to verify that the mechanical portions of the device are functioning.

3.07 ROTATIONAL TESTS

A. The Contractor shall assist Division 15 in performing rotational tests on all motors. If rotational tests determine that conductors must be transposed to change direction of rotation, the conductors shall be changed at the make-up box on the motor; or if the change is made elsewhere, then the conductor's color coding shall be changed.

3.08 INSTRUCTING OWNER'S REPRESENTATIVE

A. The Contractor shall instruct representatives of the Owner in the proper operation and maintenance of all elements of the Electrical system.

B. Contractor shall spend not less than one (1) day in such formal instruction to fully prepare the Owner's representative to operate and maintain the Electrical systems.

3.09 UL LISTINGS

A. The Contractor shall bear all responsibility for any work, which he performs, that voids any UL listings of any equipment.

3.10 OWNER OCCUPIED BUILDINGS

A. Holes cut in Owner occupied buildings shall be approved prior to any work by the structural engineer and shall be done with drills with vacuum attachments that vacuum cuttings as the drill cuts.

B. All drilling, hammering, or other loud construction activities shall be done after Owner’s normal working hours.

C. Conduit cutting will be done outside.

D. Contractor shall clean work area at the end of each day.

3.11 OBJECTIONABLE NOISE AND/OR HARMONICS

A. If after installation of the electrical system, it is found that objectionable noise or harmonics exists on the electrical system, the manufacturer of the equipment which is producing the objectionable noise or harmonics shall install the proper electrical equipment to prevent the noise and/or harmonics from emitting onto the building’s electrical system and shall be contained within the offending equipment.

3.12 VOLTAGE MEASUREMENTS

A. Contractor shall measure and record voltage at service equipment with as much load on the system as possible. Contractor shall measure and record phase-to-phase, phase-to-neutral, and phase-to-equipment ground voltages for each phase. Where harmonic cancellation transformers are installed, contractor shall also measure and record phase-to-phase, phase-to-neutral and phase-to-equipment ground voltages for each phase on the secondary side of the transformers. Contractor shall submit records of these voltages with the Operation and Maintenance Manuals.

3.13 REMOVAL OF PAINT AND OTHER FINISHES

A. The contractor shall remove all paint and other non-factory finishes applied inadvertently by other subcontractors to all electrical equipment.

3.14 TEMPORARY CONSTRUCTION POWER AND LIGHTING

A. The contractor shall provide all necessary temporary construction power and lighting to accomplish the work.

B. After the construction is completed the contractor shall remove all temporary construction power and lighting.

3.15 PROJECT PHASING

A. The contractor shall become familiar with the project phasing prior to his bidding the project and shall include in his bid, the amount of money required by him to provide the necessary labor, materials, adjustments, programming, reprogramming, and accessories to provide the project in the phases shown within the general conditions of the contract documents.

END OF SECTION

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SECTION 26 05 02
EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to elevator, plumbing, appliances, and mechanical equipment specified under other sections or Owner furnished equipment.

1.02 RELATED SECTIONS

A. Section 26 05 19 – Low-Voltage Electrical Power Connectors and Cable.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems.

C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

D. Section 26 28 16 - Enclosed Switches and Circuit Breakers.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NEMA WD 1 - General Purpose Wiring Devices.

C. NEMA WD 6 - Wiring Device Configurations.

D. NFPA 72 - National Fire Alarm Code.

E. UL 498 - Attachment Plugs and Receptacles.

F. UL 1010 - Receptacle Plug Combinations for Use in Hazardous (Classified) Locations.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

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.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

C. Conform to requirements of the Arkansas State Fire Protection Code.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections. Verify voltage, ampere, and phase ratings before beginning any of the work. Notify Engineer immediately of any discrepancies found. Any work installed that has to be replaced because of the contractor’s failure to verify these ratings will not be reimbursed. Verify that equipment furnished under other sections has disconnects and starters, if so specified in other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.

D. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.01 CORDS AND CAPS

A. Manufacturers:
   1. Hubbell.
   2. Pass & Seymour.
   3. Arrow-Hart.

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 multiconductor 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 at branch circuit overcurrent protection.

2.02 BOILER SAFETY SHUTDOWN EQUIPMENT FOR BOILERS RATED 400,000 BTUH AND HIGHER

A. Normally closed pushbutton(s) shall be equal to Square D #SK9RD5H13 with additional KA1 contacts for additional boilers.

B. Power Relay shall be equal to Square D Class 8501 Type CO-7 in a NEMA 1 enclosure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using liquidtight flexible conduit with watertight connectors.

C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.

D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.

E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices as indicated and as required by applicable codes.

G. Provide interconnecting conduit and wiring between devices and equipment where indicated.

H. All flexible conduit to pumps, chillers, air handling units, outdoor equipment, and water heaters shall be liquidtight.

I. Ground all metal equipment. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic equipment.

J. The contractor shall check overload settings, wire sizes, fuse/circuit breaker sizes & disconnect

sizes of equipment provided by others for compliance with the National Electrical Code and shall:

1. Adjust settings where possible.
2. Advise the Engineer of non-compliance where remedy will require more than just adjustments.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONNECTORS AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

1.02 RELATED SECTIONS

A. Section 26 05 29 – Hangers and Supports for Electrical Systems.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

C. Section 26 05 53 – Identification for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NETA - National Electrical Testing Association.

C. UL 83 - Thermoplastic Insulated Wires and Cables.

D. UL 486 A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

E. UL 486 C - Splicing Wire Connectors.

F. UL 1581 - Reference Standard for Electrical Wires, Cables and Flexible Cords.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide for each wire and cable type.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductors shall be copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.08 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - BUILDING WIRE AND CABLE

A. Triangle.

B. American.

C. Engineer Approved.

2.02 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 (feeder circuits) and THHN/THWN (branch circuits).

2.03 WIRING CONNECTORS/LUGS

A. All cable and wire terminals, lugs, taps, and splices shall be made secure with compression type connectors, approved for the service. Connections shall be installed with approved tools and dies to assure a permanent secure joint. Compression joints shall be cleaned and made smooth with insulating compound. Connectors in dry locations shall be wrapped with varnish cambric and insulated with approved electrical grade plastic tape. Where conductors are to be connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the connector. Lacquer coating of conduits shall be removed where ground clamps are to be installed. Provide all necessary hangers, racks, cleats, and supports required to make a neat installation. Wire connectors shall conform to UL 486.

B. Connectors in wet or damp locations shall be covered with heat shrinkable products equal to Scotch #ITCSN Series.

C. Contractor shall provide and install all connectors, taps, lugs, and splices as required to connect all wires and cables provided under the contract. Contractor shall torque all bolted connections to manufacturer’s specifications. If manufacturer’s specifications do not apply, use NETA specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation verify that interior of building has been protected from weather.

B. Prior to installation verify that mechanical work likely to damage wire and cable has been completed.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

A. Interior Locations: Use only building wire, Type THW or use THHN/THWN insulation, in raceway unless otherwise indicated on the Drawings.

B. Wet or Damp Interior Locations: Use only building wire, Type THW or THHN/THWN in raceway

or liquidtight flexible conduit.

C. Exterior Locations: Use only building wire, Type THW or THHN/THWN insulation in raceway.

D. Underground Installations: Use only building wire, Type THW or USE insulation in raceway.

E. Use wiring methods indicated on Drawings.

F. On the load side of GFIC circuit breaker, use only Type XHHW conductors.

3.04 INSTALLATION

A. Install products in accordance with manufacturers instructions.

B. Use solid conductors for feeders and branch circuits No 10 AWG and smaller, except branch circuits to motors shall be stranded copper for flexibility. Stranded conductors may be used if tapped to solid conductors before terminating to wiring devices.

C. Use stranded conductors for control circuits 24 volts and below. Minimum size shall be No. 16 AWG.

D. Use conductors not smaller than No. 12 AWG for power and lighting circuits and 120 volt control circuits.

E. Use No. 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet or where the distance to the first outlet exceeds 50 feet.

F. Use No. 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant for building wire No. 4 AWG and larger.

I. Protect exposed cable from damage.

J. Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

K. Use suitable cable fittings and connectors.

L. Neatly train and lace wiring inside boxes, equipment, and panelboards.

M. Clean conductor surfaces before installing lugs and connectors.

N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise. Split bolt connectors are not allowed.

O. Use sleeve compression connectors for copper conductor splices and taps, No. 6 AWG and larger. Insulated uninsulated conductors and connector with heat shrink insulation rated 600 volts.

P. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, No. 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, No. 10 AWG and smaller.

R. Route circuits at own discretion; however, circuit numbers shall be according to Drawings.

S. Do not share neutral or ground on computer circuits. Each circuit shall be run in a separate raceway.

T. For branch circuits, do not use common neutrals, install a dedicated neutral conductor with each circuit.

U. Run conductors of same circuit in same conduit.

V. Run conductors of different voltage system in separate conduits.

W. Color-code conductors as follows:

208Y120 Volts	Switchlegs	480Y277 Volts	Switchlegs
Phase A Black	Violet	Brown	Violet
Phase B Red	Pink	Orange	Pink
Phase C Blue	Yellow		
Ground	Green	Green	
Neutral	White	Gray	

X. Contractor shall not install more than three (3) current-carrying conductors in one conduit without derating the conductors per NEC Table 310-15(b)(2)(a).

Y. Where cables not in conduit pass through floors, cables shall be enclosed in conduit extending at least 6 inches above the floor.

Z. Cables shall be protected from physical damage where necessary by conduit.

AA. All cable splices shall be made in boxes.

BB. The radius of bends in cables shall not be less than five times the diameter of the cable.

CC. Cables shall be secured by staples, straps, j-hooks, or similar fittings every 4-1/2 feet and within 12 inches of every cabinet, box and fitting.

DD. Do not pull cable sheaths back more than necessary to separate conductors.

EE. Do not score conductors when peeling back conductor insulation. Scored conductors will be replaced.

FF. Do not cut off strands from stranded conductors at terminations. Conductors with strands missing shall be replaced.

GG. Kinked, torn, or twisted cable sheaths are unacceptable and shall be replaced.

HH. Install wire and cables to avoid chemicals, cold temperature bending, and different lengths of conductors of same circuit.

II. Make sure conduits are properly terminated, reamed and brushed before installation of wire and cables.

JJ. Cable sheaths shall be held in place by strain relief fittings.

KK. Verify proper conductor location at each termination before energizing.

LL. All parallel conductors shall be of the same length, type, size and shall have the same connector pressures.

MM. Do not splice service entrance or feeder conductors.

NN. Maintain 18 inch clearance from all wires and cables to hot water pipes, steam pipes, and flues.

OO. Route all cables parallel and perpendicular to walls. This includes cables installed above ceilings, in attics, and in crawl spaces.

3.05 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of 26 0553 – Identification for Electrical Systems.

B. Identify each conductor with its circuit number or other designation indicated on Drawings in each junction box, switch, switchboard, control panel, and in each panelboard.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

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, if applicable. If not applicable, use NETA's recommended values.

D. Verify continuity of each branch circuit conductor.

E. Check tightness of all connections.

3.07 USE OF THE FOLLOWING IS PROHIBITED

A. Aluminum conductors.

B. Wire nuts in damp or wet locations.

C. Copper-clad aluminum conductors.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

D. Chemicals.

E. Conduit.

1.02 RELATED SECTIONS

A. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. UL 467 - Grounding and Bonding Equipment.

1.04 GROUNDING ELECTRODE SYSTEM

A. Metal underground water pipe, if any.

B. Metal frame of the building, if any.

C. Electrode.

D. Rod electrode.

E. "GEM encased in direct contact with earth.

1.05 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: No greater than 5 ohms.

1.06 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 0500.

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of exothermic connectors.

1.07 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

B. Accurately record actual locations of grounding electrodes.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 ROD ELECTRODE

A. Material: Copper clad steel.

B. Diameter: 3/4 inch.

C. Length: 10 feet.

2.02 WIRE

A. Material: Stranded or solid copper.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

2.03 EXOTHERMIC CONNECTIONS

A. Cadweld.

B. Approved Equal.

2.04 CHEMICALS

A. Ground enhancement materials (50 lbs. minimum per rod).

B. Cadweld "GEM" system, or approved equal.

2.05 CONDUIT

A. Conduit shall conform to Section 26 05 33.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that final backfill and compaction has been completed around area where chemical ground is to be installed.

3.02 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Auger a 3 inch diameter hole to a depth of 9-1/2 feet.

C. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground. Drive rod 1 foot into ground. Make Cadweld connection. Pour chemicals around rod. Tamp around rod. Pour water in augered hole. Remove excess water from hole. Fill remainder of augered hole with soil. Tamp soil.

D. Provide grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

E. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus or bushing.

F. Size and type of green equipment ground conductors and method of securing then to obtain electrical continuity and effective grounding as per National Electrical Code, Article 250. Conduit shall not be used for grounding.

G. Neutrals shall be grounded in accordance with the National Electrical Code.

H. All metal raceway system, including cabinets, conduit and boxes, shall be grounded in accordance with the National Electrical Code.

I. An equipment ground conductor shall be installed in all conduits.

J. Install a grounding electrode and grounding electrode conductor at each dry type transformer.

K. The grounding electrode shall be connected to the metal structure of all buildings with metal structures and to a 1-1/2 inch or larger cold water pipe, if metallic. The ground connection to the metal structure shall be exothermic.

L. All unburied grounding conductors shall be installed in conduit.

M. Connect equipment ground conductor of branch circuits serving gas appliances to metallic gas lines. Do not use metallic gas lines as a grounding electrode of the electrical system.

N. Ground all metal non-current carrying equipment. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic equipment.

3.03 FIELD QUALITY CONTROL

A. Inspect equipment grounding conductors and connections for tightness and proper installation.

B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

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SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Conduit, cable and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NECA - National Electrical Contractors Association.

C. UL 514B - Fittings for Conduit and Outlet Boxes.

1.03 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

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.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 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. Perforated strap iron will not be acceptable as hanger or fastening material.

D. Plastic tie wraps will not be acceptable as support materials, except:
   1. Inside enclosures to neatly train cables and wires.

E. Channels shall be galvanized and not painted.

F. All hardware shall be galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and other conduit.

D. Obtain permission from the Engineer before using powder-actuated anchors.

E. Obtain permission from the Structural Engineer before drilling or cutting structural members.

F. 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.

G. Install surface-mounted cabinets with minimum of four anchors. Provide blocks between studs to support anchors.

H. In wet and damp locations use steel channel supports to stand cabinets one inch off wall.

I. All conduits, both horizontal and vertical, shall be accurately supported. Each hanger shall be properly sized to fit supported conduit.

J. Where lines are supported under concrete construction, hanger rods shall be secured with concrete inserts.

K. All hangers shall be so located as to properly grade and support horizontal conduits without appreciable sagging of these lines.

L. Where multiple conduits are run horizontally at the same elevation and grade, they may be supported on trapezes of channels suspended on rods. Trapeze numbers, including suspension rods, shall be properly sized for number, size, and loaded weight of conduits to be supported. Refer to seismic restraint requirements.

M. Conduit supports shall be installed within 3 feet of each coupling, connector, and box.

N. Electrical contractor shall install his own supports for his equipment.

O. All 2 inch and larger conduits shall have a swivel hanger support equal to B-Line #B446 or #B446C.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rigid steel conduit.

B. Flexible metal conduit.

C. Liquid-tight flexible metal conduit.

D. Electrical metallic tubing.

E. Surface mounted raceway.

F. PVC conduit.

G. Fittings and conduit bodies.

H. Wall and ceiling outlet boxes.

I. Floor boxes.

J. Pull and junction boxes.

K. Under Floor Duct

1.02 RELATED SECTIONS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems.

D. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

E. Section 26 27 26 - Wiring Devices.

F. Section 26 05 02 - Equipment Wiring Systems.

1.03 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

C. ANSI/NFPA 70 - National Electrical Code.

D. NECA "Standard of Installation”.

E. NEMA TC 3 - PVC Fittings to Use with Rigid PVC Conduit and Tubing.

F. UL 1 - Flexible Metal Conduit.

G. UL 5 - Surface Metal Raceways and Fittings

H. UL 6 - Rigid Metal Conduit.

I. UL 360 - Liquid-tight Flexible Steel Conduit.

J. UL 652 - Schedule 40 Rigid PVC Conduit

K. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

M. UL 38 - Boxes for Use with Fire-Protection Signaling Systems, Manually Actuated Signaling.

N. UL 50 - Cabinets and Boxes.

O. UL 514A - Metallic Outlet Boxes.

P. UL 514B - Fittings for Conduit and Outlet Boxes.

Q. UL 996 - Electrical Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

R. UL 1241 - Junctions Boxes for Swimming Pool Lighting Fixtures.

S. UL 1773 - Termination Boxes.

T. UL 65 - Wired Cabinets.

1.04 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.05 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide for metallic conduit, flexible metal conduit, Liquid-tight flexible metal conduit, metallic tubing, non-metallic conduit, fittings, and conduit bodies.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.06 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 2 inches.

B. Submit under provisions of Division 1.

C. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site.

B. Inspect all conduits for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit and openings prior to rough-in.

C. Route conduit as shown on Drawings in approximate locations unless specifically dimensioned. Route as required to complete wiring system.

D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. The exact location of all electrical boxes shall be as approved by Engineer who reserves the right to change any outlet for a distance of 6 feet in any direction from position shown on plans, before work is roughed-in, without extra

charge.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Minimum Size: 3/4 inch unless otherwise specified.

B. Underground Installations:
   1. Conduit installed below grade shall be Schedule 40 PVC. All elbows and riser up thru floor slabs shall be galvanized rigid steel conduit (RSC).
   2. All conduit not installed under the floor slab shall be 24 inches below grade unless otherwise noted.

C. Outdoor Locations, Above Grade, and On Roofs: Use galvanized rigid steel conduit. On roofs install 4 inch by 4 inch square treated wooden blocks on roof to support rigid steel conduit within 3'-0" of each coupling and box and to support Liquid-tight flexible conduit every 3'-0".

D. Dry Locations:
   1. Concealed: Use electric metallic tubing.
   2. Exposed:
      a. Use galvanized rigid steel conduit in unfinished areas only (Electric Room, Mechanical Room) unless noted otherwise.
      b. Use surface metal raceway where specifically indicated in finished areas of existing buildings where it is impossible to fish flexible metallic conduit down inside of existing walls.

E. Mechanical and Electrical Rooms:
   1. Use 6'-0" maximum length Liquid-tight flexible conduit for final connections to mechanical equipment and dry type transformers. Support all flexible conduit every 3'-0".
   2. Use galvanized rigid steel conduit where exposed.

F. Electrical metallic tubing (EMT) is to be used for all HVAC equipment control wiring. The conduit system for HVAC temperature controls is to be furnished and installed by Division 15 in accordance with the requirements specified herein. Line voltage control work not specifically shown on the electrical drawings shall be furnished and installed by Division 15 with all line voltage work and all conduit work performed by licensed electricians.

G. Use surface metal raceway only in existing facilities where conduit cannot be fished down walls or across finished ceilings. Surface metal raceway shall not be used in new buildings, unless noted on the Drawings.

2.02 RIGID STEEL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Rigid Steel Conduit: ANSI 80.1

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.03 FLEXIBLE METAL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Description: Interlocked steel construction.

C. Fittings: ANSI/NEMA FB 1.

D. Maximum Length: 6'-0".

2.04 LIQUID-TIGHT METAL CONDUIT

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: ANSI/NEMA FB 1.

D. Maximum Length: 6'-0".

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied.
   2. Triangle.
   3. Engineer Approved.

B. Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; die-cast compression type.

2.06 SURFACE METAL RACEWAY

A. Manufacturers:
   1. Wiremold.
   2. Engineer Approved.

B. Description: Surface metal raceway with hidden supports.

C. Fittings, Boxes, and Conduit Bodies: As manufactured by surface metal raceway manufacturer.

2.07 NONMETALLIC CONDUIT

A. Manufacturers:
   1. Carlon.
   2. Engineer Approved.

B. Description: NEMA TC 3; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.08 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, include 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.
   3. Receptacle, single switch, and 2 gang switch boxes for wood studs shall be Raco #194 or #235 with plaster ring of proper depth.
   4. Receptacle, single switch, and 2 gang switch boxes for metal studs shall be Raco #196 or #235 with plaster ring for proper depth.
   5. Gang switches of 3 or more devices for wood or metal studs and exposed work shall be Raco #950 Series, appropriate gang box and raised cover.
   6. Lighting fixture outlet boxes for wood or metal studs, masonry walls, and furred ceilings shall be Raco #166, #167, or Raco #194 or #235 with plaster ring.
   7. Junction boxes for wood or metal studs, masonry walls, furred ceilings and interior exposed

work shall be Raco #231, #232, #233, or #235.

8. Receptacle boxes for masonry walls shall be Raco #695 or #191 with #785 device cover.
9. Switches in 6 inch and wider masonry walls shall be 3-1/2 inch deep masonry boxes of gang required. Masonry boxes in 4 inch walls shall be 2-1/2 inches deep.
10. Television outlet boxes shall be Raco #246, 4-1/16 inch box with #836 device cover ring. Telephone outlet boxes shall be Raco #256.
11. Outlet boxes for interior exposed work in unfinished areas shall be Raco #191, #192, #231, or #232 boxes with 1/2 inch raised, 4 inch square cover of appropriate configuration.
12. Boxes, for interior exposed work on existing walls and ceilings in finished areas in existing buildings, where it is impossible to fish conduit down walls or above ceilings, shall be boxes as manufactured by the surface metal raceway manufacturer for the intended purpose.

B. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer.

C. Boxes shall be oversized when required by Table 370-16(a) of the National Electrical Code.

2.09 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Surface-Mounted Cast Metal Box: NEMA 250, Type as required; flat-flanged, surface-mounted junction box.
   1. Material: Galvanized steel.

C. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

2.10 UNDER FLOOR DUCT

A. Under floor duct systems shall be as specified on the Drawings, installed per the manufacturer’s directions/requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install conduit in accordance with NECA "Standard of Installation”.

B. Install surface metal raceway in accordance with manufacturer’s directions.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers. Supports shall be installed within 3 feet of every outlet box, junction box, panel, or other conduit terminations. Fastening of unbroken lengths shall be permitted to be increased to a distance of 5 feet where structural members do not readily permit fastening within 3 feet. Do not space supports further than 10 feet apart.

E. Group related conduits; support using conduit rack. Construct rack using steel channel.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route all conduit parallel and perpendicular to walls. This includes conduit installed above ceilings, in attics, on roofs, and in crawl spaces.

K. Install insulated bushings or approved equivalent on each end of all conduit.

L. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 °F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Install no more than equivalent of four 90° bends between boxes. Use factory elbows for all 90° bends in conduits 1" and larger.

P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Q. Provide suitable fittings to accommodate expansion and deflection where conduit crosses expansion joints.

R. Use suitable caps to protect installed conduit against entrance of dirt and moisture during construction.

S. Ground and bond conduit under provisions of Section 26 05 26.

T. Identify conduit under provisions of Section 26 05 53.

U. Provide suitable pull-boxes in all conduit runs as required by the National Electrical Code and as required to facilitate wire installation.

V. Holes for passage of conduits through all one-hour and two-hour drywall partitions shall be neatly cut to the required size. If holes are cut larger than necessary, they shall be covered with two (2) additional pieces of 5/8 inch type X gypsum wallboard, each 8 inches by 16 inches with a half circular cutout of the proper size, one (1) layer on one-hour partitions, and two (2) layers on two-hour partitions.

W. Holes for passage of conduits through one-hour, two-hour, and four-hour masonry walls shall be fireproofed. Fireproofing materials shall be as follows:
   1. Cellular Glass Insulation: Pittsburgh Corning Corp. Foamglas "Regular" or UL rated or UNI-JAC UL rated pipe insulation, or approved equal.
   2. Fire Retardant Putty: IPC Flame-safe Type FAS500 or FST600 Series, or improved equal, for one-hour and two-hour walls.
   3. IPC/KB5 Mortar Seal, or approved equal (full depth of wall) for four-hour walls.

X. Holes for passage of conduits through masonry floors shall be fireproofed. Fireproofing material shall be Firestop Compound - IPC Flame-safe Type 500/FST 600, or approved equal, filled to full depth of slab. Minimum annular space around conduit shall be 3/16 inch.

Y. Refer to Architectural drawings for locations of fire-rated walls, ceilings, and floors.

Z. Support 2-1/2 inch and larger conduit in accordance with Section 23 05 48.

AA. All flexible conduits in Mechanical Rooms and outside shall be Liquid-tight flexible conduit.

BB. All conduits that enter a building's basement wall below grade shall have a fitting equal to OZ Type CSBI installed inside the conduit and shall be watertight sealed between outer conduit wall and basement opening.

CC. Conduits, which enter refrigerated areas, such as walk-in coolers and wall-in freezers, shall have a seal-off installed on the non-refrigerated side of the conduit where the conduit exits or enters the refrigerated area.

DD. Make sure conduits are properly terminated, reamed, and brushed before installation of wire or cable.

EE. Install bushings on all conduits.

FF. Structural Engineer shall approve placement of conduits in all concrete slabs, beams, and columns. See Structural Drawings for structural engineer's name and address.

GG. Conduits which pass from an air conditioned space to a non-air conditioned space shall have seal-offs installed on non-air conditioned side near wall.

HH. Ground the metallic conduits.

II. Install gasketed conduit hubs on all conduits exiting the top or sides of NEMA 3R enclosures.

JJ. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

KK. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

LL. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

MM. Install boxes to preserve fire resistance rating of partitions and other elements.

NN. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

OO. Use flush mounting outlet boxes in finished areas, unless noted otherwise on the Drawings.

PP. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inch separation in acoustic rated walls. See Architectural floor plans for acoustic rated wall locations.

QQ. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

RR. Use stamped steel bridges to fasten flush mounting outlet box between studs.

SS. Install flush mounting box without damaging wall insulation or reducing the effectiveness.

TT. Use adjustable steel channel fasteners for hung ceiling outlet box.

UU. Do not fasten boxes to ceiling support wires.

VV. Support boxes independently of conduit.

WW. Use gang box where more than one device is mounted together. Do not use sectional box.

XX. In other than masonry, use 4-inch square by 1-1/2 inch minimum box with plaster ring for single devices.

YY. Use cast outlet box in exterior locations exposed to the weather and wet locations.

ZZ. Use cast floor boxes for installations in slab on grade. See plans for specialty A/V floor-boxes equal to FSR. Coordinate cover trim with floor covering thickness and type.

AAA .Set floor boxes level.

BBB. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
1. Interior Dry Locations: Use hinged enclosure.
2. Other Locations: Use surface-mounted cast metal box.

CCC. Locate boxes so outlets are not obstructed by pipes, ducts, or other items.

DDD. Boxes for light switches shall generally be located within 6 inches of door jamb.

EEE. Pull-boxes shall be provided at points shown on plans or required to overcome mechanical difficulties due to arrangement of runs or the fixed characteristics of the building construction. No runs of over 100 feet shall be made without use of pull-box.

FFF. All boxes shall have covers. All boxes installed above a ceiling and installed in unfinished spaces (Mechanical and Electrical Rooms, etc.) shall have the covers clearly and legibly marked with the circuits contained within them.

GGG. All flush-mounted boxes shall come within 1/4 inch of finished non-combustible surfaces and shall be flush with finished combustible surfaces. Install box extensions, if after rough-in and wall construction, the boxes do not come out far enough.

HHH. Fireproof all poke-through devices in accordance with manufacturer’s directions.

III. Ground all boxes. Ensure that bonding breaks through paint to bare metallic surface.

JJJ. Grind ears off of 2-gang boxes with isolated ground receptacles in each box. Grinding shall be done in a machine shop.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance of partitions and other elements.

B. Pull-boxes shall be provided at points shown on the plans or required to overcome mechanical difficulties due to arrangement of runs or the fixed characteristics of the building construction.

C. All threaded conduit shall be secured to boxes, cabinets, panels, switches, etc. by means of a threaded bushing on the inside and lock-nutted on the box exterior and interior.

D. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

E. Coordinate mounting heights and locations of outlets mounted above counters, branches, and backsplashes with Architect prior to rough-in.

F. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.03 THE FOLLOWING ARE PROHIBITED

A. EMT crimp-on, tap-on, indenter type fittings.

B. EMT set- screw fittings. Set-screw fittings on ends of flexible conduit are allowed.

C. PVC inside buildings, or above grade.

D. All thread nipples in other than dry locations.

E. Wooden plugs inserted in concrete or masonry units as bases for fastening conduits, tubing, boxes, cabinets, or other equipment.

F. Installation of conduit or tubing which has been crushed or deformed.

G. Where conductors #8AWG or larger are inside, the following fittings shall not be used:
1. 90° threaded hubs.
2. Pulling elbows.
3. Bushed elbows.
4. Short box connectors.
5. 90° connectors.
6. Entrance elbows.
7. Types LB, LL, LR, T, L, TA, TB, X, LBD, or LBDN conduit bodies.
8. Short elbows.

H. Type ENT tubing.

I. Armored cable.

J. Metal-clad cable.

K. EMT on roof, exposed, outside, in concrete, or underground.

L. Flexible or Liquid-tight flexible conduits concealed in walls or floors.

M. PVC elbows.

N. Storage of PVC in sunlight.

O. The use of heat to bend PVC conduit.

P. Surface non-metal raceway.

Q. Surface metal raceway in new buildings.

R. Surface metal raceway in damp or wet locations.

S. Flexible or Liquid-tight flexible conduits in lengths exceeding 6'-0".

T. The use of external cover-clips on surface metal raceway.

U. All steel EMT fittings.

V. Flexible conduit connectors on which the flexible conduit is threaded.

W. Plastic boxes.

X. Fiberglass boxes.

END OF SECTION

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SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. The requirements for seismic protection measures to be applied to electrical equipment specified herein are in addition to any other items called for in other sections of these specifications. The seismic protection shall conform to Category D of the 2007 Arkansas Fire Prevention Code. The electrical equipment shall include the following items to the extent required on plans or in other sections of the following specifications:

Conduit, 2-1/2 inches or larger
Panelboards
Cable Trays
Switches
Light Fixtures
Switchboards
Communication Racks

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Requirements - Section 26 05 00.

1.03 APPLICABLE PUBLICATIONS

A. American National Standards Institute, Inc. (ANSI):
1. B18.2.1-1981
2. B18.2.2-1972

B. American Society for Testing and Materials (ASTM):
1. A36-84a
2. A307-84
3. A325-85
4. A501-84
5. A576-81

C. Federal Specifications:
1. RR-W-410D

D. NEMA
1. 250 Enclosures for Electrical Equipment
2. IC56

1.04 REGULATORY REQUIREMENTS

A. Conform to NFPA 70 - National Electrical Code and International Building Code.

B. Conform to 2007 Fire Prevention Code.

PART 2 - PRODUCTS

2.01 Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown.

2.02 Sway brace of structural steel conforming with ASTM A36.

2.03 Mechanical couplings of the sleeve type to provide a tight flexible joint under all reasonable conditions.

2.04 Square-head bolts and heavy hexagon nuts, ANSI B18.2.1 and B12.2.2 and ASTM A307 or 306.

2.05 Guy wires where required shall conform to Fed Spec. RR-W-441 as follows:

5/32" diameter	Type V, Class 1
3/16" to 5/16" diameter	Type V, Class 2
1/4" to 5/8" diameter	Type I, Class 2

PART 3 - EXECUTION

3.01 All rigidly mounted equipment will have a minimum of four (4) anchor bolts securely fastened through bases or backs. Anchor bolts must conform to ASTM A307. Anchor bolts shall have an embedded straight length equal to at least twelve times the nominal diameter of the bolt and shall conform to the applicable tables for various equipment weights.

Maximum Equipment Weight (Pounds)	
500	½
1,000	½
5,000	1/2
10,000	1/2
20,000	1/2
30,000	5/8
50,000	3/4
100,000	1

Based on four (4) bolts per item; a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Use equivalent total cross-sectional area when more than four bolts per item are provided. Anchor bolts that exceed normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths. When height-to-width ratio of the equipment exceeds 8.9, overturning must be investigated. Expansion anchors shall not be used to resist seismic or vibratory loads unless test data are provided to verify the adequacy of the specific anchor and application. In no case shall the expansion anchor size be less than that required for bolts in the preceding table. Selection of anchor bolts for vibration isolation devices and/or snubbers to equipment base and foundations shall follow the same procedure, except that an equipment weight equal to five times the actual equipment weight shall be used. Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 0.5 inches.

3.02 Equipment Sway Bracing shall be provided for all items supported from overhead floor or roof structures. Braces shall consist of angles, rods, bars, or pipes run at a 45° angle from the equipment frame to the building structure secured at both ends with no less than 1/2 inch bolts. Braces shall conform to all applicable codes and standards for Seismic Classification. Bracing shall be provided in two planes of directions, 90° apart, for each item of equipment. Details of all equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45°, provided that supporting members are properly sized to supporting operating weight of equipment when inclined at a 45° angle.

3.03 All recessed fluorescent light fixtures shall have seismic clips firmly situated over tops of ceiling grid tees or plaster frames.

3.04 Sway bracing shall be provided for all 2-1/2 inch or larger conduits, not individually supported with hangers 12 inches or less in length.

3.05 All 2-1/2 inch or larger conduits entering or leaving a building or structure shall have a flexible seismic expansion fitting installed within the earth prior to entering the building or after leaving the building. Fitting shall be within 5'-0" of building or structure. Fitting shall be equal to Appleton Type DF.

3.06 All light fixtures that weight more than 50 pounds shall have a safety chain or safety cable in addition to its other support.

3.07 Sway bracing shall be provided for all cable trays.

3.08 Communications racks shall be bolted to floor. Tops of racks shall be bolted to walls.

3.09 Cable trays and conduits shall be independently supported and braced independently of the ceiling.

3.10 Powder-activated fasteners (shot pins) shall not be used for anchorage.

3.11 Vibration isolators shall have a bumper restraint in each horizontal direction, and vertical restraints shall be provided where required to resist overturning.

3.12 Internal coils of dry type transformers shall be positively attached to their supporting substructure within the transformer enclosure.

3.13 Slide-out components in electrical equipment shall have a latching mechanism to hold contents in place.

3.14 Electrical cabinet design shall conform to NEMA 250 and NEMA IC56.

3.15 The attachment of additional items weighing more than 100 pounds to electrical equipment is prohibited.

3.16 Friction clips shall not be used for anchorage attachments.

3.17 Oversized plate washers extending to the equipment wall shall be used at bolted connections through the base sheet metal if the base is not reinforced with stiffeners or not capable of transferring the required loads.

END OF SECTION

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Trench tape.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.03 RELATED SECTIONS

A. Section 09 9100 - Painting: Boxes.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

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, and installation of Product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:
   1. Each electrical distribution equipment (switchboards, panelboards, enclosed circuit breakers, motor control centers, transformers) and control equipment enclosure (starters, disconnect switches, etc.).

C. Letter Size:
   1. Use 1/2 inch letters for identifying equipment designation and voltage.

D. Provide typewritten directory in each panelboard of circuit designations in clear/transparent protective envelope attached to inside of panelboard door.

E. Provide typewritten zone directory in each conventional fire alarm control panel in clear/transparent, protective envelope attached to inside of central panel door.

F. Provide nameplate on inside of each panelboard and main indicating color code scheme for the voltage of that panelboard and main, nameplates to be red with white characters.

2.02 WIRE MARKERS

A. Description: Tape or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters switchboard gutters, motor control center

gutters, pull boxes, outlet and junction boxes, disconnect switches, motor starters, and at each load connection.

C. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.03 TRENCH TAPE

A. Tape shall be detectable aluminum foil polyethylene laminate.

B. Tape shall be the following color and have the following wording:

Application	Color	Caution Wording
Electrical	Red	“Caution – Electric Line Buried Below”

C. Tape shall be equal to Panduit Type HTDU with width to match trench width.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using No. 4 round heat cadmium plated, steel self-tapping screws or nickel-plated brass plates.

C. Identify underground conduits using underground warning tape. Install one tape per trench at 6 inches below finished grade.

D. All fire alarm junction boxes and pull-boxes shall be painted red where concealed or exposed in mechanical or electrical rooms.

E. Both ends of pull-wires shall be identified by means of labels or tags, reading "PULLWIRE" and shall be numbered to refer to same pull-wire.

F. Install nameplates at each circuit breaker on all switchboards and large panelboards.

G. Install wire markers on wires in each junction box, panelboard, switchboard, control panel, etc.

H. Install typewritten ”COMPUTER” with black letters and clear background on each cover-plate of receptacles adjacent to information outlets

I. Install nameplates at each device within motor control centers.

J. Install directory of addresses and corresponding devices and locations in each addressable fire alarm and security control panels.

K. All security junction boxes and pull-boxes shall be painted yellow where concealed or exposed in mechanical or electrical rooms.

L. Install labels on all telephone and computer cables.

M. All telephone junction boxes and pull-boxes shall be painted white where concealed or exposed in mechanical or electrical rooms.

N. Paint all data junction boxes and pull-boxes blue where concealed or exposed in mechanical or electrical rooms.

O. Paint all public address junction boxes and pull-boxes dark gray where concealed or exposed in

mechanical or electrical rooms.

P. Paint all television cable junction boxes or pull-boxes black where concealed or exposed in mechanical or electrical rooms.

END OF SECTION

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SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Branch circuit panelboards, new and existing.

B. Distribution panelboards, existing.

1.02 RELATED SECTIONS

A. Section 09 91 00 - Painting: Touchup.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems.

C. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Engraved nameplates.

1.03 REFERENCES

A. NECA (National Electrical Contractors Association) "Standard of Installation."

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA PB 1 - Panelboards.

D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less.

E. NFPA 70 - National Electrical Code.

F. UL 67 - Panelboards.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker 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.

1.05 RECORD DOCUMENTS

A. Record actual locations of Products; indicate actual branch circuit arrangement.

1.06 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.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.10 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.11 MAINTENANCE MATERIALS

A. Provide two of each panelboard key.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Siemens/ITE.

B. General Electric.

C. Square D.

D. Cutler-Hammer.

E. Existing panelboards and switchboard are Siemons.

2.02 PANELBOARDS

A. Panelboards: NEMA PB1, circuit breaker type.

B. Panelboard Bus: Tin-plated copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

C. Minimum short circuit rating shall be as indicated on the Drawings. Panelboards shall have a fully rated interrupting rating. Series-rated equipment will not be accepted.

D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. Install new circuit breakers in existing panelboards and switchboard as noted on the Drawings. Provide all bus ties, etc. as required.

E. Enclosure: NEMA PB 1, Type 1, or 3R as indicated on the Drawings.

F. Cabinet box: 6 inches deep; width: 20 inches for 240 volt and less panelboards.

G. Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb. Provide supports in accordance with Section 16190.

C. Install panelboards with middle at 48 inches, if less than 6'-6" tall. If panelboard is taller than 6'-6 inches, install with top at 7'-6".

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 16195.

G. Provide a minimum of four (4) spare 20A/1P circuit breakers in each branch circuit panelboard or as indicated on the drawings.

H. Install all screws and bolts in cover-plates.

I. Install knockout plugs in all unused openings in enclosure.

J. Install nameplates on all circuit breakers of large panelboards.

K. Bolt panelboards to mounting surface in accordance with Section 26 05 48.

L. Panelboards installed on basement walls or outside on exterior walls shall be installed on 1-1/2 inch channel.

M. The first section of multi-section panelboards shall have feed-through lugs. Contractor shall install conductors with ampacities equal to the bus rating of the panelboards, from the feed-through lugs to the main lugs only of Section #2 panelboard.

N. Touchup scratched or marred surfaces to match original finish.

O. Neatly form wire inside of panelboard.

3.02 FIELD QUALITY CONTROL

A. 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.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections using calibrated torque wrench for circuit breakers, bus stabs, and busses.

END OF SECTION

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SECTION 26 26 00
LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Arrangement with Utility Company for permanent and temporary electric services, including payment of Utility Company charges for service.

B. Underground service entrance.

C. Metering equipment.

1.02 RELATED SECTIONS

A. Section 31 21 00 – Earth Moving.

B. Section 31 23 23 - Backfilling.

C. Section 31 23 16 - Trenching.

D. Section 03 30 00 - Cast-In-Place Concrete for pad mounted transformers and/or free-standing C.T. cabinets.

E. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

F. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

G. Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NETA – National Electrical Testing Association.

1.04 SYSTEM DESCRIPTION

A. Utility Company: Entergy of Arkansas.

B. System Characteristics: 208 volts, three phase, four- wire, 60 Hertz.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.06 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

B. Conform to the requirements of NFPA 70 - National Electrical Code, ANSI/IEEE C2 - National Electrical Safety Code, and Arkansas Public Service Commission rules and

regulations.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 - PRODUCTS

2.01 UTILITY METERS

A. Meters will be furnished and installed by Utility Company.

2.02 UTILITY METER BASES

A. Meter bases will be purchased by Contractor from Utility Company and installed by the Contractor.

2.03 UTILITY CURRENT TRANSFORMER CABINET

A. Current transformer cabinet shall be purchased by Contractor from Utility Company and shall be installed by Contractor per directions from Utility Company.

2.04 TRANSFORMER PAD

A. Description: Concrete transformer pad with cable pit sized as indicated on Drawings.

2.05 GROUND GRID

A. Stranded copper conductors, exothermic connections, and copper clad steel ground rods as directed by Utility Company.

2.06 LUGS

A. Contractor shall provide lugs to the Utility to connect underground service conductors to pad-mounted transformer secondary terminals.

2.07 CONDUITS

A. Above ground conduit shall be threaded rigid steel.

B. Underground conduit shall be Schedule 80 with IMC elbows.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that service equipment is ready to be connected and energized.

3.02 PREPARATION

A. Make arrangements with Utility Company to obtain permanent and temporary electric services to the Project.

B. Coordinate location of Utility Company's facilities to ensure proper access is available.

C. Pay all fees for electrical service to Utility Company.

3.03 INSTALLATION

A. Install service entrance conduits and conductors from Utility Company's transformer to building service entrance equipment.

B. Provide cast-in-place concrete pad and ground grid for Utility Company transformer and/or free-standing C.T. cabinet, under the provisions of Section 03 30 00.

C. Provide buried PVC conduit from primary compartment of transformer pad to Utility Company's pole as directed by Utility Company.

D. Install meter and current transformer cabinet as directed by Utility Company.

E. Provide and install secondary lugs at transformer and lugs at current transformer cabinet.

F. Level concrete pads.

G. Dress up areas of excavation.

H. Ground enclosures, current transformers, and meter.

I. Install conduit hubs when exiting the top or sides of a NEMA 3R enclosure.

J. Install weatherheads on ends of conduits for overhead services.

K. Install meters, current transformer cabinets, and outdoor service equipment on 1-1/2 inch channels.

3.04 FIELD QUALITY CONTROL

A. Torque lugs to NETA specifications.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Occupancy Sensors.

D. Device plates.

1.02 RELATED SECTIONS

A. Section 26 05 33 - Boxes.

B. Section 26 05 53 - Electrical Identification: Labels on computer outlets.

1.03 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

C. UL 20 - General Use Snap Switches.

D. UL 498 - Attachment Plugs and Receptacles.

E. UL 894 - Switches for Use in Hazardous (Classified) Locations.

F. UL 1010 - Receptacle Plug Combinations for Use in Hazardous (Classified) Locations.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Instructions:
   1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
   2. Include instructions for storage, handling, protection, examination, preparation, operation, and installation of product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.06 EXTRA MATERIALS

A. Provide protective rings and split nozzles as required and as specified.

PART 2 - PRODUCTS (NO SUBSTITUTIONS)

2.01 WALL SWITCHES

A. Single Pole Switch:
   1. Hubbell #1221.
   2. Pass & Seymour #20AC1.

3. Cooper Wiring Devices #2221.
4. Leviton #1221.

B. Three-way Switch:
1. Hubbell #1223.
2. Pass & Seymour #20AC3.
3. Cooper Wiring Devices #2223.
4. Leviton #1223.

2.02 RECEPTACLES

A. Single Convenience Receptacle:
1. Hubbell #5361.
2. Pass & Seymour #5361.
3. Cooper Wiring Devices #5361.
4. Leviton #5361.

B. Duplex Convenience Receptacle:
1. Hubbell #5362.
2. Pass & Seymour #5362.
3. Cooper Wiring Devices #5362.
4. Leviton #5362.

C. GFCI Receptacle:
1. Hubbell #GF5352.
2. Pass & Seymour #2091.
3. Cooper Wiring Devices #XGF20.
4. Leviton #GF5352.
5. Hubbell #GFTROXX for Tamper Resistant.

D. Color of devices as selected by Architect/Engineer.

2.03 OCCUPANCY SENSORS

A. APPROVED MANUFACTURES
1. Hubbell
2. WattStopper
3. Engineer Approved

B. TYPE: Sensors shall be “Dual Technology” unless otherwise noted on plans

C. INSTALLATION
1. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the “On” / “Off” function of the lights.
2. Time Delay settings shall be set at 10 minutes. This delay selection is based on lamp life vs. energy savings and sensor performance. Corridors and Bathroom time delay shall be set for 30 minutes to provide safety in such areas.
3. Contractor shall adjust sensor sensitivity so the device will operate properly.
4. Manufacture specified on drawings is specific to design. If an alternate manufacture is selected, the contractor is responsible for additional sensors, power pack, and additional equipment to meet the design needs. Also, contractor is to provide manufactures drawings with sensor coverage located on drawings. The revised drawing shall be included with the shop drawings. Alternate plan will only be approved once the engineer has reviewed this information.

2.04 WALL PLATES

A. Cover Plates: Stainless steel.

B. Weatherproof Enclosures:
1. Receptacles in wet locations shall be installed with an outlet enclosure clearly marked "Suitable for Wet Locations While in Use”. There shall be a gasket between the enclosure

and the mounting surface, and between the cover and the base to assure proper seal.

2. The enclosure must employ stainless steel mounting hardware and be constructed of impact resistant polycarbonate. The outlet enclosure shall be UL listed and shall be as manufactured by TayMac Corporation, or approved equal.

C. Wall-mounted Occupancy Sensors: Cove-plates shall be suitable for sensor type and shape.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

E. Verify color of all devices and cover-plates.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install single and double pole switches with OFF position down.

D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

E. Install plates on switch, receptacle, and blank outlets in all areas.

F. Connect wiring devices by wrapping conductor around screw terminal in clockwise direction and tightening screw. Where wiring device has two (2) plates tightened by a screw, this method may be used. However, other back-connected wiring devices, which depend upon a metal spring action, are not allowed.

G. Use jumbo size plates for outlets installed in masonry walls.

H. Install galvanized steel plates on outlet boxes and junction boxes above accessible ceilings, and on surface mounted outlets.

I. All plates shall be secured by means of screws with heads matching plates.

J. Vertically mounted receptacles shall be installed with equipment grounds down, unless local codes require otherwise. Horizontally mounted receptacles shall be installed with equipment grounds to the right, unless local codes require otherwise. Regardless, all receptacles, including GFCI receptacles, shall be installed in the same way with the ground, turned in the same direction.

K. Install labels on computer outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switches 48 inches above finished floor to the center of the box.

C. Install convenience receptacle 18 (vertically oriented) inches above finished floor unless noted otherwise on Drawings.

D. Install convenience receptacle 6 (horizontally oriented) inches above finished counter.

3.05 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.

F. Check tightness of all conductor connections.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fusible switches.

B. Non-fusible switches.

C. Fuses.

D. Enclosed circuit breakers.

1.02 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators.

B. NECA (National Electrical Contractors Association) “Standard of Installation”.

C. NEMA AB 1 - Molded-Case Circuit Breakers.

D. NEMA KS 1 - Enclosed Switches.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment.

G. UL 98 - Enclosed and Dead-Front Switches.

H. UL 198C - High Interrupting Capacity Fuses; Current Limiting Type.

I. UL 198E - Class R fuses.

J. UL 363 - Knife Switches.

K. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures.

L. UL 1066 - Low Voltage AC and DC Power Circuit Breakers Used in Enclosures.

M. UL 1332 - Organic Coatings for Steel for Outdoor-Use Electrical Equipment Enclosure.

1.03 RELATED SECTIONS

A. Section 09 91 00 - Painting: Touchup.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems.

C. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems.

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 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.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Disconnect switches shall be heavy duty, as manufactured by,
   1. Square D
   2. General Electric
   3. Siemens ITE
   4. Cutler-Hammer

2.02 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, Type HD 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. Non-fusible Switch Assemblies: NEMA KS 1, Type HD 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.

2.03 ENCLOSED CIRCUIT BREAKERS

A. Enclosures: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R, lockable, freestanding where indicated.

B. Minimum integrated short circuit rating as indicated on the Drawings shall be fully rated rating. Series-Rated equipment will not be accepted.

C. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

D. Cabinet: Finish in manufacturer's standard gray enamel.

E. 480Y277 volt main circuit breakers rated 1000 amperes or more shall have ground fault protection.

2.04 FUSES

A. Manufacturers:
   1. Bussman.
   2. Gould-Shawmut.
   3. Little.

B. Description: Dual element, current limiting, time delay, one-time fuse, 600 volt, UL 198E, Class RK 1.

C. Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the electrical device where indicated.

B. Install fuses in fusible disconnect switches.

C. Install equipment ground bus in enclosed circuit breaker / switch.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

E. Provide label on outside cover as directed by Section 26 05 53 - Identification for Electrical Systems.

F. Provide three (3) spare fuses of each type utilized.

G. Bolt enclosed circuit breaker / switch to mounting surface in accordance with Section 26 05 29.

H. Where wall-mounted circuit breaker / switches are mounted to be operated from floor or grade, install switch with middle of switch at 48 inches, if switch is less than 6'-6" tall. If switch is taller than 6'-6" tall install, switch with top of switch at 7'-6".

I. When the electrical devices are installed on exterior basement walls or outside, the switches shall be mounted on 1-1/2 inch channels.

J. Enclosed switches for wall-mounted exhaust fans installed higher than 8’ from the floor shall be installed high on the wall next to the exhaust fan.

K. Install nameplate on disconnect switch with designation of equipment being served by switch. If main switch, install “Main Disconnect” nameplate.

L. Touchup scratched or marred surfaces to match original finish.

M. Neatly form wires inside switches.

3.02 FIELD QUALITY CONTROL

A. Check tightness of conductor lugs using calibrated torque wrench.

END OF SECTION

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SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires and accessories

B. LED luminaires

C. Exit signs.

D. Emergency lighting units.

E. Inverters

F. Fluorescent Ballasts.

G. Lamps.

H. Luminaire accessories.

1.02 RELATED SECTIONS

A. Section 09 90 00 - Painting: Touchup.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

C. Section 26 05 29 – Hangers and Supports for Electrical Systems.

D. Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps - Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. ANSI/NFPA 70 - National Electrical Code.

E. ANSI/NFPA 101 - Life Safety Code.

F. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

G. UL 844 - Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.

H. UL 924 - Emergency Lighting and Power Equipment.

I. UL 1570 - Fluorescent Lighting Fixtures.

J. UL 1571 - Incandescent Lighting Fixtures.

K. UL 1572 - High Intensity Discharge Lighting Fixtures.

L. NEMA SSL 1-2010 – Electronic Drivers for LED Devices, Arrays, or Systems

1.04 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 05 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.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each luminaire.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1 and Section 26 05 00.

B. Maintenance Data: Include replacement parts list.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Conform to requirements of NFPA 101.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.01 LUMINAIRES

A. Furnish products as specified on Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

C. All factory installed wiring shall be copper.

2.02 LED LUMINAIRES

A. Furnish products as specified on Drawings.

B. Color Temperature of 3500K for interior luminaires as listed in the fixture schedule on the plans, unless otherwise noted. The color temperature of exterior LED luminaires shall not exceed 4100K (nominal), unless otherwise noted.

C. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and

a minimum of 70 for exterior luminaires.

D. Luminaire shall maintain 70% lumen output for a minimum of 50,000 hours.

E. Driver shall have a rated life of 50,000 hours, minimum.

F. Lumen output shall not depreciate more than 20% after 10,000 hours of use.

G. LED driver shall be compatible with dimming controls where dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.

H. LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the fixture schedule on the plans without visible flicker or “popcorn effect”. “Popcorn effect” is defined as the luminaire being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

I. The LED luminaire shall carry a limited 5-year warranty minimum (not pro-rated) for LED light engine(s)/board array, driver(s), and LED components.

2.03 EXIT SIGNS

A. Manufacturers: As indicated on Drawings.

B. Description: Self-contained exit sign fixture.

C. Housing: High impact thermoplastic unless indicated otherwise on Drawings.

D. Face: As indicated on Drawings.

E. Directional Arrows: As indicated on Drawings.

F. Mounting: As indicated on Drawings.

G. Battery: Nickel-cadmium with sufficient capacity to operate lights for 90 minutes.

H. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.

I. Lamps: Manufacturers standard LED lamps.

J. Input Voltage: 120/277 volts.

2.04 EMERGENCY LIGHTING UNITS

A. Manufacturers: As indicated on the Drawings.

B. Description: Self-contained emergency lighting units.

C. Housing: High impact thermoplastic.

D. Mounting: As indicated on the Drawings.

E. Battery: Nickel-cadmium sealed maintenance fee, capable of operating lights for 90 minutes

F. Battery Charger: Dual-rate type, with sufficient capacity to recharge battery to full charge

within 12 hours.

G. Lamps: Manufacturer's standard incandescent lamps.

H. Input Voltage: 120/277 volts.

I. Test Circuit: "Push-to-test" batteries and lamps.

2.05 INVERTERS

A. Inverter Manufacturers:
1. Bodine
2. Dual-Lite
3. Evenlite

B. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.

2.06 BALLASTS

A. Fluorescent Ballast:
1. Description: ANSI C78.1, C62.41 Category A, high power factor electronic type, less than 10 percent harmonic distortion, with resetting thermal protectors, equal to Advance Mark V.
2. Provide ballast suitable for lamps specified.
3. Voltage: Match luminaire voltage.
4. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc. Sound level shall be Class A.

B. Emergency Ballasts:
1. All emergency ballasts for one or two lamp operation shall be equal to Bodine B-50 with a 5 year warranty (not pro-rated).
2. All emergency ballasts shall meet UL 924.

2.07 LAMPS

A. Fluorescent Lamp Manufacturers:
1. Osram/Sylvania.
2. Phillips.
3. General Electric.

B. HID Lamp Manufacturers:
1. Phillips
2. Sylvania
3. Venture

C. Provide lamp type specified for luminaire.

D. Fluorescent lamps shall be of the low mercury type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.02 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. In seismic design category D, E, & F, fixtures installed in lay-in ceiling grid shall be supported as follows in addition of being securely fastened to the ceiling grid. Refer to specification section 26 05 48 for additional fixture support information.
   1. Less than 10lbs: one 12-gauge safety wire connected to structure.
   2. More than 10lbs but less than 56lbs: two 12-gage safety wires connected to structure.
   3. More than 56lbs: shall be supported directly from structure independent of the ceiling grid

C. Locate recessed ceiling luminaires as indicated on Architectural 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 prohibit movement.

E. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips. On non-fire rated lay-in ceilings, Contractor shall install surface-mounted fluorescent light fixtures on 1-1/2 inch spacers.

F. Install recessed luminaires to permit removal from below. Final connections to lay-in light fixtures shall be made with 6'-0" flexible conduit from junction box to light fixture. Flexible conduit shall not go from light fixture to another light fixture.

G. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating at ceiling.

H. Install clips to secure recessed grid-supported luminaires in place.

I. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on Drawings as scheduled.

J. Install all accessories furnished with each luminaire or as required for a complete installation as indicated.

K. Connect luminaires, emergency lighting units and exit signs to outlets provided under Section 26 0533 as indicated.

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. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

O. All fixtures shall be guaranteed for a period of one year after final acceptance and any defects in material or workmanship during this period shall be replaced or repaired to the Engineer's satisfaction without extra cost.

P. All supports, safety chains, swivels, etc. shall be furnished as required for a complete installation.

Q. Securely fasten all exit signs and emergency lighting units to surface to which they are mounted.

R. Replace all broken or cracked lens.

S. Replace all scratched or bent reflectors and doorframes.

T. Light fixtures shall be supported by lay-in ceilings or by supports to the building structure.

U. Light fixtures shall not be supported from conduits, duct or piping.

V. All recessed light fixtures shall have seismic clips firmly situated over tops of ceiling grid tees or plaster rings.

W. All light fixtures that weigh more than 50 pounds shall have a safety chain or safety cable in addition to its other support.

X. 2 by 2 light fixtures shall have louvers and lamps oriented in the same direction.

Y. Touchup scratched or marred surfaces to match original finish.

Z. Surface-mounted light fixtures shall be mounted at least 80 inches above the floor to the bottom of the light fixtures.

3.03 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

B. Turn off circuit breakers serving emergency self-contained ballasts, emergency lighting units, and self-contained exit signs to verify that emergency lighting is working properly.

3.04 ADJUSTING

A. Aim and adjust luminaires as indicated on Drawings or as directed.

B. Adjust exit sign directional arrows as indicated.

C. Relamp luminaires that have failed lamps at Substantial Completion. Fluorescent lamps that fail within the first 90 days of operation will be considered defective and shall be replaced at no extra cost.

D. If Owner complains of glare from light fixtures; add glare control, adjust light fixtures, or relocate light fixture as required to remove objectionable glare.

3.05 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

END OF SECTION