

DIVISION 15 - MECHANICAL AND PLUMBING
SECTION 15000 - GENERAL MECHANICAL

PART 1.00 GENERAL CONDITIONS

1.01 WORK INCLUDED

- A. The general conditions of the general specifications are made a part of these specifications and apply the same as if attached hereto. The contractor should, before bidding, read and thoroughly understand all general conditions, priority and scheduling.

1.02 SCOPE OF WORK

- A. This section calls for the furnishing of labor, materials, equipment, and all the services, and of performing all operations required for the complete mechanical systems as hereinafter specified and/or shown on the accompanying drawings.

1.03 GENERAL REQUIREMENTS

- A. Contractor shall install his work to meet the existing conditions as found at buildings and property, and to accommodate work of other trades. This contractor shall be responsible for timely placing of sleeves in forms before concrete is poured. Cooperate with the general contractor and place pipes and ducts in floors, walls, furred spaces, etc., so there will be no delay. Sheet metal or iron pipe sleeves shall be provided for pipes passing through floors, wall or partitions.
- B. Contractor shall furnish and properly install materials, devices, equipment, insulation, controls, appurtenances, etc., mentioned in these specifications and/or shown on plans or required to make a complete and satisfactory installation in working order whether fully shown or not.
- C. Contractor should visit the site and acquaint himself thoroughly with conditions governing installation of his work. The Contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the Contract. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible.
- D. All other plans shall be checked in relation to these plans so that all conditions will be furnished and installed in this contract to provide complete and satisfactory systems.
- E. It is intended that all HVAC devices, piping, etc. be located symmetrically with all architectural elements. Refer to Architectural, Structural, Electrical, Plumbing plan and details in completing the required coordination.

1.04 LAWS, RULES, REGULATIONS, FEES, ETC.

- A. The entire mechanical work shall comply with rules and regulations of the local and state authorities having jurisdiction including the State Fire Marshal, State Board of Health, and Department of Health and Hospitals. All modifications required by the said authorities at

any time shall be made by the mechanical contractor without additional charge. In cases where alterations to or deviations from this specification and accompanying plans are required by the authorities, contractor shall report same to the Architect and obtain his approval before work is started.

1.05 DRAWINGS

- A. Plans and detail sketches are submitted to limit, explain, and define structural conditions, specified requirements, pipe sizes, and manner of erecting work. Structural or other conditions may require certain deviations from manner of installation shown, and such deviations shall be made as required, but specified sizes and requirements necessary for satisfactory operation shall remain unchanged.
- B. It may be necessary to shift or to change routing of ducts and or piping and this shall be done, but such changes must be referred to Architect for approval before proceeding. Extra charges will not be allowed for these changes.
- C. Typical details are shown on plans, and in any cases where Contractor is not certain about the method of installation of this work, he shall ask for details, lack of details will not be an excuse for improper installation.
- D. Contractor bidding on this portion of the work must be fully experienced in installations of equal size, complexity and quality. In bidding, he acknowledges that he fully understands the scope of the work and design and has the ability, for the contract price to assemble and install the equipment, piping, and ductwork shown or specified, so as to mold same into a satisfactory workable system and arrangement, without responsibility for capacities and sizes set by these documents.
- E. Contractor shall recognize that the amount of information and detail that could be provided in Contract Documents is limitless and could extend into every minute detail, step, sequence, and operation to a point where only workmen would be required, without drawing on ability experience, and ingenuity of the Contractor.
- F. The drawings indicate required size and points of termination of piping and ductwork, and suggest proper routes to conform to structure avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of the contractor to make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or cost to the Owner.

1.06 MATERIALS

- A. Where directed by the Architect, Contractor shall submit sample for approval before proceeding.

1.07 STANDARDS

- A. In general, standards for products and workmanship shall be as described in each individual section.

- B. The standards referred to, except as modified in these specifications shall have full force and effect as though printed in these specifications. These standards are not furnished to bidders for the reason that the manufacturers and trades involved are assumed to be familiar with their requirements. The Architect will furnish, upon request, information as to how copies of the standards referred to may be obtained.
- C. Notwithstanding any reference in this section of the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalogue number, such references shall be interpreted as establishing a standard of quality and shall not be construed limiting competition and the Contractor in such cases, may at his option, use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect, expressed in writing, is equal to that specified.

1.08 MATERIALS SPECIFIED OR SUBSTITUTED (Prior Approvals)

- A. Refer to Instructions to Bidders.

1.09 SHOP DRAWINGS

- A. Before proceeding with the work, contractor shall make complete shop and working drawings of such apparatus or connections as directed by the Architect and/or hereinafter specified. These drawings shall show construction details and dimensions of each piece of equipment so drawn.
- B. Architects approval of shop drawings shall not relieve the Contractor from responsibility of incorrectly figured dimensions or any other errors in these drawings or specified even though approved by the Architect, shall not relieve this Contractor from furnishing and erecting same.
- C. Ten (10) sets of prints of shop drawings shall be submitted to Architect. These prints shall be supplied as part of this contract. Submit all shop drawings at the same time or as soon as practical after award of the contract. No separate items will be accepted.
- D. Where laws or local regulations provide that certain accessories such as gauges, thermometers, relief valves and parts be installed on equipment, it shall be understood that such accessories shall be furnished if no specific reference to them is made in the specifications.
- E. Contractor shall verify voltage of all equipment with Electrical prior to ordering.

1.10 CUTTING AND PATCHING

- A. All cutting necessary for this work will be done by this Contractor at his own expense, but all patching shall be done by the General Contractor. No beams or joists shall be cut without prior approval of Architect. After initial resurfacing has been done any further cutting, patching or painting shall be done at the expense of this Contractor.

1.11 INTERFERENCES

- A. The drawings are generally diagrammatic and this Contractor shall harmonize his work with that of the different trades so that interferences of the different equipment, piping, etc., shall be installed so as to function properly. In the case where interference develops, the Architect is to state which equipment, piping, etc., is to be relocated regardless of which item was first installed.

1.12 EXCAVATION AND BACKFILL

- A. This Contractor shall do all excavating required to lay the specified services and after same have been laid, he shall do all backfilling to the satisfaction of all parties concerned and shall cart away from the premises all unnecessary dirt, rubbish, etc., as directed. Backfill shall be well tamped. All backfill shall be done according to the "Compaction And Backfill" section of these specifications.

1.13 SPACE REQUIREMENTS

- A. Contractor shall check all plans pertaining to this job so as to be fully aware of the space limitations for all various items of equipment. Equipment is not to be bid on, submitted for preliminary approval nor placed on the job if it is so bulky and large that adequate access for proper maintenance and servicing cannot be achieved in the space provided.

1.14 FOUNDATIONS AND SUPPORTS

- A. This contractor shall furnish and install foundations and supports of concrete or steel shapes for equipment requiring same, unless specifically indicated otherwise or specified.
- B. All floor mounted mechanical equipment shall be mounted on 4" high concrete housekeeping pad unless specifically shown otherwise on plans. Refer to plans for special requirements for foundations and supports.

1.15 HANGERS, ESCUTCHEONS, ETC.

- A. See Section 15140 – Supports and Anchors.
- B. Mechanical Contractor shall furnish and install all thimbles, inserts and other requirements necessary for the support of his equipment and piping. Assist and cooperate with other trades in locating and placing these items.

1.16 CEILING AND WALL ACCESS PANEL

- A. Factory made access doors and frames, prime coat finish, screw driver latch(s) of suitable size as required.
- B. Access panels in rated ceiling to have same rating as ceiling.
- C. Where valves, dampers, controls, fire dampers, smoke dampers, and detectors, reheat coils, etc. are concealed in walls or non-accessible ceilings, install factory made access doors and frames.

1.17 DUCTWORK ACCESS PANELS

- A. Access panels in ductwork to be double wall type with insulation sandwiched in between, same insulation value as adjacent ductwork.

1.18 SIPHON PREVENTERS

- A. Furnish and install approved type siphon preventors on all equipment and fixtures in such a manner as to prevent water being siphoned back into the water supply in the event the water supply is shut off.

1.19 FLAME SPREAD PROPERTIES OF MATERIALS

- A. All materials and adhesives used for acoustical linings, jackets and insulation shall comply with requirements of NFPA 90A and 90B and UL guide # 40V.8.15. Products exceeding a flame spread rating of 25, or a smoke developed rating of 50, as determined by ASTM Test Method E-84 are prohibited. Adhesives and sealers shall be fire retardant and fire resistant when dry. Flame proofing treatments which are subject to decomposition, deterioration, or the effects of moisture are prohibited.

1.20 DOMESTIC AND FIRE WATER TIE-IN

- A. Contractor shall provide any necessary meters and tap fees for domestic or fire water tie-ins to utility companies. All domestic and fire water taps shall have aboveground reduced pressure back flow preventors near the tie-in point. Coordinate with Engineer exact location.
- B. All backflow preventors shall be heat traced and insulated with 1-1/2" fiberglass insulation with water tight aluminum jacket.

1.21 PROTECTION OF EQUIPMENT

- A. See individual sections for protection of equipment.
- B. This Contractor shall at all times take such precautions as may be necessary to properly protect his equipment from damage. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Architect will be sufficient cause for the rejection of the particular piece of equipment in question.

1.22 TESTING

- A. All pressure lines, unless elsewhere specified, shall be tested under 150# hydrostatic pressure unless rated pressure is less for a minimum of 5 hours. Contractor shall provide valve at farthest point in line to bleed off air and for inspection.
- B. Notice shall be given the Architect before tests are made, the test is not to be drawn off pipes and pipes are not to be covered or insulated until filled pipes have been examined and testing approved by the Architect.

- C. In case of defects, they shall be made good to the satisfaction of the Architect and work retested. All such work shall be done by the Contractor with no additional expense to the Owner.
- D. Contractor shall make any other such tests as may be called for by the Architect, and all other tests so called for elsewhere in these specifications.

1.23 CLEANING AND ADJUSTING

- A. Before receiving final approval from the Architect, the Contractor shall clean out all lines; adjust all valves, control equipment and other equipment. Clean all pipe and equipment and leave the entire installation in good working order. All heaters, fans, grilles, controls, etc., shall be adjusted to perform in correct and satisfactory manner, with sequences, etc., as called for in the specifications hereinafter specified and on plans.

1.24 PAINTING

- A. Refer to Section 09900 – Painting and Coating and 15190– Mechanical Identification for painting requirements.

1.25 MOTORS, MOTOR STARTERS AND ELECTRICAL WORK

- A. Refer to Section 15170 - Motors.
- B. Motors shall be suitable for voltage indicated on the plans, plus or minus 10% and be designed for constant operation at 40 degrees C ambient, 65 degrees C rise for class A, 90 degrees C rise for Class B, etc. Electrical equipment furnished under this contract shall meet standards as set forth by NEMA and NEC requirements. All electrical equipment shall be UL labeled.

1.26 PARTS LIST AND INSTRUCTION MANUAL

- A. See individual sections for specific instructions.
- B. This Contractor shall deliver to the Architect three (3) copies of printed instructions relating to operating, proper maintenance and repair parts list indicating the various parts by name, number and diagram for each piece of equipment installed. Test and balance report shall also be included in parts list and instruction manual.
- C. The shop drawings, parts list, and maintenance and repair instructions shall be neatly bound in a canvas-covered notebook and turned over to the Architect before acceptance of the work.

1.27 GUARANTEE

- A. Contractor shall guarantee materials, equipment and workmanship installed and performed under this contract for a period of one (1) year from date of the final completion and official acceptance of the contract unless otherwise stated.

- B. He shall furnish free of charge to the Owner all materials and labor necessary to comply with the above guarantee, which shall be based on defective materials and/or workmanship, and on such basis shall be responsible if a deficiency is found, for any adjustment, replacement, or correction which may be necessary to replace the project to first class condition. This guarantee shall include refrigerant charges, but shall not include the changing of filters.

1.28 RECORD DRAWINGS

- A. The Contractor shall maintain a set of record drawings on-site throughout the construction. The record drawings shall reflect accurate dimensional record of all underground, buried, above ceiling, or otherwise concealed work.
- B. The Contractor shall maintain these record documents and keep them up-to-date daily.

END OF SECTION

DIVISION 15 - MECHANICAL AND PLUMBING

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1.00 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Mechanical demolition.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Concrete bases.
 - 10. Supports and anchorages.

1.02 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

- A. Welding certificates.

1.04 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2.00 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.03 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.04 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.05 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.06 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.07 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3.00 EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.

- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.05 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

- C. Field Welding: Comply with AWS D1.1.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.08 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15170 - MOTORS

PART 1.00 GENERAL

1.01 SECTION INCLUDES

- A. Single phase electric motors.
- B. Three phase electric motors.

1.02 RELATED WORK

- A. Section 15860.

1.03 REFERENCES

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
- D. ANSI/NEMA MG 1 - Motors and Generators
- E. ANSI/NEMA 70 - National Electrical Code

1.04 SUBMITTALS

- A. Submit product data under provisions of Sections 01300 - Administrative Requirements & 15000 – General Mechanical.
- B. Submit test results verifying nominal efficiency and power factor for three phase motors larger than 5 horsepower.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01700 - Execution Requirements.
- B. Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture of electric motors for commercial use, and their accessories, with documented product development, testing, and manufacturing experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01600– Product Requirements.
- B. Store and protect products under provisions of Section 01600– Product Requirements.
- C. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. (For extended outdoor storage, remove motors from equipment and store separately).

1.09 WARRANTY - See General Section 15000 – General Mechanical.

PART 2.00 PRODUCTS

2.01 MOTORS

- A. Motors controlled by VFD's shall comply with NEMA MG1, Part 31, Definite Purpose Inverter Fed Motors (withstand repeated voltage peaks of 1600V with rise times of 0.1 microseconds and greater).
- B. Starters for single phase motors which are not automatically started shall be manual type with melting alloy thermal overload protection and pilot light. Starters for automatically controlled single phase motors shall be magnetic type with NEMA rated AC magnetic contactor, melting alloy thermal overloads and pilot light.
- C. Starters for three phase motors 25 horsepower and below shall be combination type starter/disconnect, full voltage non reversing (FVNR), with magnetic NEMA rated contactors rated for horsepower of motor served, adjustable trip magnetic circuit breaker disconnect (circuit breaker, not a fused switch) capable of being padlocked in the open position, 10K a/c minimum fault rating with higher rating when necessary due to available fault levels. Starters shall have a fused 100VA minimum control transformer (120V unless required otherwise), HOA switch, push to test operating pilot light, solid state overload relays set for actual motor nameplate full load amps, phase failure and phase reversal protection relay, minimum two NO. and two N.C auxiliary contacts and terminal blocks factory prewired for field wiring. Starters shall be housed in a NEMA 1 enclosure for indoor locations and NEMA 3R enclosure for outdoor or wet locations.
- D. Starter for motors 30 horsepower and above shall be soft start type or variable frequency drives
- E. Coordinate with electrical and specify fault rating on all motor controllers.

2.02 MANUFACTURERS

- A. Electrical Service - Refer to Division 16 for required electrical characteristics.

- B. Motors: Design for continuous operation in 40 degrees C environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, Service Factor, and motor enclosure type.
- C. Visible Nameplate: Indicating motor information as required by NEC 430-7(a).
- D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.
- E. Starters:
 - 1. General Electric
 - 2. Square-D
 - 3. Westinghouse
 - 4. Allen-Bradley
 - 5. Furnas

2.03 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A 65 degree C temperature rise insulation, Minimum 1.15 service factor, pre-lubricated sleeve or ball bearings, automatic reset overload protector.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Motors: Capacitor in series with starting winding; capacitor-start/capacitor-run motors shall have two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A 65 degree C temperature rise insulation, NEMA service factor, prelubricated sleeve ball bearings.
- G. Enclosed Motors: Class A 65 degree C temperature rise insulation, NEMA service factor, prelubricated sleeve ball bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between one and one-half times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pullout Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Conform to ANSI/NEMA MG for design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Testing Procedure: In accordance with ANSI/IEEE 12, Test Method B. Load test motors to determine freedom from electrical or mechanical defects and compliance with performance data.
- G. Motor Frames: NEMA standard T-frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- H. Thermister System (Motor Frame Sizes 254T and larger): Three PTC thermister imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
- I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for re-lubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- J. Sound Power Levels: To ANSI/NEMA MG1.
- K. Nominal Efficiency: Meet or exceed values in schedules at full load and rated voltage when tested in accordance with ANSI/IEEE 112, and ASHRAE 90.1.
- L. Motors, Motor Starters and Electrical Work: Mechanical Contractor shall furnish all motors, motor starters, start-stop push buttons, pilot lights, firestats, interlocking diagrams, etc. for each piece of motor driven equipment under this Contract. Mechanical Contractor shall install all motors. All motor starters, start-stop push buttons, pilot lights, etc. shall be turned over to the Electrical Contractor for installation. Electrical contractor shall be responsible for power wiring. This contractor will be responsible for control wiring.
- M. Motor Starters and Push Buttons: All automatic starters shall be nominal 600 volt rating. All starters shall have two (2) auxiliary contacts.
 - 1. Starters for single speed motors, 3/4 through 25 HP inclusive, shall be magnetically operated, "Across-the-line" 3 phase, with three overload relays, "HAND-OFF-AUTO" selector switch and pilot in cover. Starters shall be combination type with fused or circuit breaker type disconnect mechanism.
 - 2. Starters for 30 HP and larger are to be reduced voltage, auto-transformer,

combination type with fused or circuit breaker type disconnect mechanism. Starters shall be complete with three overload relays, "HAND-OFF-AUTO" selector switch and pilot lights.

3. Enclosures for starters mounted indoors shall be NEMA 1. Enclosures for starters mounted outdoors or in wet areas shall be NEMA 3 R.
4. Remote push button stations shall be as follows: Start-stop stations shall be recess mounted with neon pilot lamp of proper voltage.
5. Push buttons for controls which are interlocked with automatic controls shall be maintained contact type. All others may be of momentary contact type.
6. Control voltage for all motor starters shall 120 volts provided by integral control voltage transformers.
7. If the Mechanical Contractor purchases equipment of larger horsepower than specified or shown on the plans, he shall pay all costs to increase the wiring and conduit.

PART 3.00 EXECUTION

3.01 APPLICATION

- A. Motors drawing less than 250 watts and intended for intermittent service may be germane to equipment manufacturer and need not conform to these specifications.
- B. Motors shall be open drip-proof type, except where specifically noted otherwise.
- C. Single phase motors for shaft mounted fans or blowers shall be permanent split capacitor type.
- D. Mount motor starter in their own individual enclosures or in a factory-built starter panel.

3.02 NEMA OPEN MOTOR SERVICE FACTORS

HORSEPOWER	3600 RPM	1800 RPM	1200 RPM	900 RPM
1/6-1/3	1.35	1.35	1.35	1.35
1/2	1.25	1.25	1.25	1.15
3/4	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15

3.03 MOTOR EFFICIENCY

- A. Each motor furnished on the job must meet ASHRAE 90.1 and shall have a minimum guaranteed efficiency as listed in table below. Minimum guaranteed efficiencies for all motors shall be clearly stamped on motor nameplate. The lack of such stamp shall be cause for rejection of motor.

=====	
HORSEPOWER	EFFICIENCY
=====	
1, 1-1/2, 2	84.00

3	88.50
5, 7-1/2, 10	90.20
15, 20	91.70
25, 30, 40	93.00
50, 60, 75	94.10
100, 125, 150, 200	95.00

END OF SECTION

DIVISION 15 - MECHANICAL AND PLUMBING
SECTION 15190 - MECHANICAL IDENTIFICATION

PART 1.00 GENERAL

1.01 WORK INCLUDED

- A. Identification of all mechanical products installed under this Division.

1.02 RELATED WORK

- A. Section 09900 - Painting: Identification painting.

1.03 REFERENCES

- A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS

- A. Submit product data under provisions of Section 01300– Administrative Requirements.
- B. Mechanical and plumbing contractors shall coordinate color codes and marking procedures.

1.05 APPROVAL OF PRODUCT PRIOR TO BIDDING

- A. Refer to Instructions to Bidders, Page IB-3, Paragraph 4.3 Substitution.

PART 2.00 PRODUCTS

2.01 MATERIALS

- A. Color: Unless specified otherwise, conform with ANSI/ASME A13.1.
- B. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background color.
- C. Metal Tags: Brass with stamped letters, tag size minimum 1-1/2 inch (38 mm) diameter with smooth edges.
- D. Stencils: With clean cut symbols and letters of following size:

OUTSIDE DIAMETER OF INSULATION OF PIPE	LENGTH OF COLOR FIELD	SIZE OF LETTERS
3/4" - 1-1/4"	8"	1/2"
1-1/2" - 2"	8"	3/4"
2-1/2" - 6"	12"	1-1/4"

8" - 10"	24"	2 - 1/2"
Over 10"	32"	3 - 1/2"
Ductwork & Equipment	-----	2 - 1/2"

- E. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing printed markings.
- F. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6" wide by 4 mil thick manufactured for direct burial service.

PART 3.00 EXECUTION

3.01 PREPARATION AND INSTALLATION:

- A. Degrease and clean surfaces to receive adhesive for identification material.

3.02 INSTALLATION

- A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners, or adhesive.
- B. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.
- C. Plastic type Pipe Markers: Install complete around pipe in accordance with manufacturer's instructions.
- D. Underground Plastic Pipe Markers: Install 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.
- E. Equipment: Identify air handling units, pumps, heat transfer equipment, tanks and water treatment devices, and motor starters with plastic nameplates. Small devices, such as in-line pumps, may identified with plastic tags.
- F. Controls: Identify control panels and major control components outside panels with plastic nameplates.
- G. Valves: Identify valves in main and branch piping with tags.
- H. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side penetration of structure or enclosure, and at each obstruction.

3.03 PAINTING

- A. All surfaces requiring painting shall be left clean. All painting shall be done by the General Contractor's painting Subcontractor. All exposed piping or insulation, convectors, grilles, or fans, in building or on roof will be painted. Paint pipe, equipment, hangers and accessories in Equipment Rooms including covering and foundations with two (2) coats of approved

paint after thoroughly cleaning. Equipment having factory finish shall be touched up and given one (1) additional coat of machinery enamel color as selected. The above shall be done by the General Contractor. See Section 09900.

- B. All piping in all equipment rooms shall be identified with pipe markers with directional arrows. The following color code shall be followed.

LEGEND	PIPING	DIRECTIONAL MARKER	BAND COLOR BACKGROUND
Domestic Water	Green	Green	White

NOTE: On any asphalt finished surfaces, prime with one (1) coat of aluminum paint before final color.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15260 - PIPING AND EQUIPMENT INSULATION

PART 1.00 GENERAL

1.01 WORK INCLUDED

- A. Piping Insulation
- B. Jackets and Accessories
- C. Equipment Insulation
- D. Duct Insulation

1.02 RELATED WORK

- A. Section 15890 - Ductwork

1.03 REFERENCES

- A. ANSI/ASTM C547 - Mineral Fiber Preformed Pipe Insulation
- B. ANSI/ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
- C. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate
- D. ASTM E845 - Surface Burning Characteristics of Building Materials.
- E. NFPA 255 - Surface Burning Characteristics of Building Materials.
- F. UL 723 - Surface Burning Characteristics of Building Materials.

1.04 QUALITY ASSURANCE

- A. Applicator: Company specializing in application of piping insulation.
- B. Materials: Flame spread/fuel contributed/smoke developed rating of 25/50/50 in accordance with ASTM E84, NFPA 255.0, UL 723.

1.05 SUBMITTALS

- A. Submit product data for each application as per Section 01300.
- B. Submit manufacturer's installation instructions.

PART 2.00 PRODUCTS

2.01 INSULATION

- A. After all work has been tested and found to be leak free and tight, and accepted by the Architect, insulate as follows:
1. All domestic hot and cold piping above ground shall be covered with 1" thick fiberglass, molded type sectional pipe covering complete with FRJ jacket. Sections of pipe covering shall be joined together, the mastic to be buttered on only one of the two adjoining surfaces at both the Longitudinal and circumferential joints so that a complete seal at the joints is obtained. The piping insulation will be secured in place with copper wire spaced not more than 12 on center. All domestic water piping insulation shall be continuous. Contractor shall not cut insulation to fit around structural items. No exceptions.
 2. Insulate the square to round connections on each air handling unit with 3" thick 3/4 lb. density insulation board using stick pins randomly spaced 18" apart. Insulation board shall have aluminum vapor barrier.
 3. Fittings, flanges, valves, etc., shall be covered with molded or fabricate covers of same material as pipe covering and shall be finished with two (2) coats of white vapor barrier mastic reinforced with 20-20 mesh glass fabric.
 4. Insulate all VAV boxes, rectangular supply, return, exhaust, and fresh air ducts with 3" thick 3/4 lb. density fiberglass insulation with reinforced aluminum vapor barrier. Seal all joints with duct tape.
 5. All round and flat oval supply air ducts shall be wrapped with 3" thick, 3/4 lb. density fiberglass insulation with reinforced aluminum vapor barrier. Seal all joints with 2" duct tape.
 6. Insulate cooling coil condensate drain lines from air handling units with 1/2" thick aerotube type insulation tied on and sealed over with tape.
 7. Insulate back of all ceiling diffusers with 3" thick fiberglass with reinforced aluminum vapor barrier.
 8. All outdoor mechanical piping shall be covered with aluminum jacket, water tight.

PART 3.00 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Continue insulation with vapor barrier through penetrations.
- C. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- D. Neatly finish insulation at supports, protrusions, and interruptions.

END OF SECTION 15260

DIVISION 15 - MECHANICAL
SECTION 15300 - FIRE PROTECTION SYSTEM

PART 1.00 GENERAL

1.1 WORK INCLUDED:

- A. The General Conditions of the Contract and Supplementary Conditions of the Contract shall govern the work under this Section of the Specifications. The Contractor is specifically directed to refer to said conditions.
- B. It is understood that these specifications, and the accompanying drawings, complement complete apparatus, fully erected and in successful operating condition. All work must be preformed in the best and most substantial manner.
- C. These specifications are intended to provide complete, and in proper operation, all sprinkler system piping, equipment, heads, valves, controls, air compressor, and accessories, all as specified herein or shown on the accompanying drawings, or reasonably implied in either. The building shall be provided with complete coverage sprinkler system for the spaces designated on the drawings classification as required. System shall consist of a calculated dry system unless indicated otherwise. Verify all pertinent criteria. The systems shall conform to layout shown and meet all requirements of agencies listed under "REGULATIONS AND STANDARDS" below. Refer to plans and specifications for additional information.
- D. Pipe, fittings, valves, and connections for fire protection and sprinkler systems shall be furnished by fire protection contractor.

1.2 RELATED WORK:

- A. Section 15310 - Wet-pipe Sprinkler Systems.

1.3 SYSTEM LAYOUT:

- A. Where plans indicate layout of system components, the layout shall be verified to comply with "REGULATIONS AND STANDARDS" and shall be revised if required to comply. The location of the sprinkler system piping and components shall be coordinated with all other trades. Revisions to sprinkler system layout shall be at Sprinkler Contractor's expense. Any such revisions shall be verified with the Architect.

1.4 ELECTRICAL WORK:

- A. See "COORDINATION".

1.5 SPRINKLER SYSTEM CONTRACTOR:

- A. It is intended that the work under this section is to be preformed by a qualified Fire Protection Piping Systems Contractor regularly engaged in this type of work. The Contractor is to hold a

current license to perform this work and be certified by the State Fire Marshall. All documents shall bear this certification.

1.6 REGULATIONS, STANDARDS AND REFERENCES:

- A. It is the intention of these specifications and the accompanying drawings, that all elements and features of the fire protection system shall be in accordance with the standards of the National Fire Association (NFPA), the State Fire Marshall, all applicable building codes and Property Insurance Association of Louisiana whether so indicated or not. NFPA standards are on file in office of Engineer and may be examined at the Contractor's request.
- B. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 150.
- C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150. Interior of building.
- D. Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
- E. NFPA 13 - Installation of Sprinkler Systems.
- F. NFPA 14 – Standpipe and Hose Systems.

1.7 QUALITY ASSURANCE:

- A. Conform to NFPA 13 for sprinkler systems.
- B. Conform to NFPA 14 for standpipe hose systems.
- C. Welding Materials and Procedures: Conform to ASME Code.
- D. Employ certified welders in accordance with ANSI/ASME Section 9. AWS D10.9.
- E. Valves: Bear UL FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.8 SUBMITTALS:

- A. Submit product data under provisions of section 01300.
- B. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.
- C. Indicate valve data and ratings.

1.9 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver and store valves in shipping containers, with labeling in place, under provisions of Section 01600.

- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures. Maintain in place until installation.

1.10 AREAS SUBJECT TO FREEZING:

- A. For areas requiring protection and not receiving direct heating during times of potential freezing, such as building overhangs, porches, canopies, attics, etc. provide a compressed air dry pipe system for these areas only, see drawings for locations. Coordinate electrical requirements with contractor.

1.11 MANUFACTURER'S OR TRADE NAMES:

- A. Where the plans or specifications mention the names of manufacturers or the products of specific manufacturers, it is intended that the Contractor shall furnish the item or items as specifies. Products of manufacturers that are not mentioned shall be subject to prior review by the Engineer and shall in any case mentioned shall be subject to prior review by the Engineer and shall in any case be in accordance with regulations and standards as state above.

1.12 SHOP DRAWINGS AND SUBMITTAL DATA:

- A. Within fifteen (15) days of award of the contract, the contractor shall submit six (6) copies of system piping shop drawings and six (6) copies of manufacturer's data and descriptive literature and drawings for all equipment and materials. Additionally, provide a reproducible (sepia) copy of the system piping shop drawings. All drawings, literature and data on all equipment shall be submitted at the same time; this material shall contain complete layout, capacity data, dimensions and other pertinent information necessary for the Architect to properly review and evaluate the item that necessary to meet the requirements for submittal to the State Fire Marshall.
- B. The contractor shall obtain approval of agencies listed under "REGULATIONS AND STANDARDS" before submitting to the Engineer, except that the date for State Fire Marshall's review shall be submitted to the Engineer prior submitting to the Fire Marshall. All required review fees and applicable requirements shall be by the contractor. No item of equipment or material shall be place on order until Final Review comments have been received from the Architect. See "DRAWINGS" below.

1.13 ORDINANCES, RULES AND REGULATIONS:

- A. All material and construction shall conform to the requirements of all building, plumbing and sanitary codes and laws in force in the locality in which the work is to be done. All materials and construction shall also conform to the rules and regulations listed above under "REGULATIONS AND STANDARDS".

1.14 DRAWINGS:

- A. The contractor shall submit detailed drawings for all sprinkler system showing exact locations

and sizes of all elements in the system before fabrication is begun. Engineer shall have the prerogative of changing the position or configuration of these systems without changing the total scope of work involved to comply with "REGULATIONS AND STANDARDS".

1.15 GUARANTEE:

- A. The contractor shall guarantee all materials and workmanship under this contract for a period of one (1) year from date of final acceptance of his work and shall repair or replace any such defective materials and workmanship without cost to the Owner.
- B. The guarantee shall include complete service, including adjustment service and inspection, during the guarantee period as required by agencies listed under "REGULATIONS AND STANDARDS".

1.16 APPROVAL OF PRODUCT PRIOR TO BIDDING

- A. Refer to Instructions to Bidders, Page IB-3, Paragraph 4.3 Substitutions.

PART 2.00 PRODUCTS

2.1 PIPE AND TUBE:

- A. See Section – 15310 Wet-pipe Sprinkler System
- B. Underground pipe shall be C900 to within 5' of building

2.2 PIPE FITTINGS:

- A. Steel Fittings: ANSI/ASME B16.9, wrought steel, butt welded. ANSI/ASME B16.25, butt weld ends. ASTM A234, wrought carbon steel and alloy steel. ANSI/ASME B16.5, steel flanges and fittings. ANSI/ASME B16.11, forged steel socket welded and threaded.
- B. Cast Iron Fittings: ANSI/ASME B16.1, flanges and fittings. B16.4, screwed fittings.
- C. Malleable Iron Fittings: ANSI/ASME B16.3, screwed type. ANSI/ASTM A47.

2.3 JOINT MATERIALS:

- A. Solder: ANSI/ASTM B32, 95/5 alloy.
- B. Brazing: ANSI/AWS A5.8.
- C. Threaded Joint Compound.

2.4 UNIONS, FLANGES, AND COUPLINGS:

- A. Unions: 150 psi malleable iron for threaded ferrous piping.

- B. Flanges: 150 psi forged steel slip-on flanges for ferrous piping.
- 2.5 ACCEPTABLE MANUFACTURER - GATE VALVES:
- A. Nibco 637-31
 - B. Central 722 U Series
 - C. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.
- 2.6 GATE VALVES:
- A. Bronze, rising stem, inside screw, solid wedge.
- 2.7 ACCEPTABLE MANUFACTURERS - GLOBE OR ANGLE VALVES:
- A. Nibco GS-132-U
 - B. Crane 143
 - C. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.
- 2.8 GLOBE OR ANGLE VALVES:
- A. Bronze, rising stem, inside screw, renewable composition disc.
- 2.9 ACCEPTABLE MANUFACTURERS - CHECK VALVES:
- A. NIBCO CS-172
 - B. Crane 147
 - C. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.
- 2.10 CHECK VALVES:
- A. Iron body, bronze trim, swing disc, renewable disc and seat.
- 2.11 ACCEPTABLE MANUFACTURERS - BUTTERFLY VALVES:
- A. Nibco LD 3510-2 Series
 - B. Central Fig. 570 or 580
 - C. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.

2.12 BUTTERFLY VALVES:

- A. Iron body, bronze stainless steel disc and stem extended for insulated work, resilient replaceable liner seat.

2.13 ACCEPTABLE MANUFACTURERS - DRAIN VALVES:

- A. Nibco F-667-0 Series
- B. Central 722 U Series
- C. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.

2.14 DRAIN VALVES:

- A. Brass ball valve with cap and chain, 3/4 inch (19 mm) hose thread.

2.15 VALVE OPERATORS:

- A. Provide handwheels for gate, globe or angle, and drain valves.
- B. For butterfly valves provide gear operators for sizes 8 inches and larger. For smaller sizes provide level lock handle with toothed plate.

2.16 VALVE CONNECTIONS:

- A. Provide valve connections to match pipe joints. Use valves of pipe size.
- B. For copper tube, provide threaded solder adapters for connection to valve.
- C. Provide butterfly valve with tapped lug body when used for isolating service.

2.17 SIAMESE FIRE DEPARTMENT CONNECTIONS:

- A. Provide two-way standard siamese fire department connection with chrome plated finish, local fire department threads, dust caps and chains, 3/4" automatic drip, marked "SPRINKLER - FIRE DEPARTMENT CONNECTION:..

2.18 ACCEPTABLE MANUFACTURERS - SPRINKLER HEADS:

- A. Reliable Automatic Sprinkler
- B. Viking Corp.
- C. Tyco-Fire
- D. Substitutions: Under provisions of Instruction To Bidders, Page IB-3, Paragraph 4.3.

PART 3.00 INSTALLATION

3.1 GENERAL:

- A. Furnish and install in a neat workmanlike manner, all piping shown on drawings or that is specified or required to provide a complete, properly operating installation. All piping and accessories shall conform to standards as applicable.
- B. Run piping parallel with the lines of the building, unless specifically shown or noted otherwise. All pipe, fittings, valves, etc., shall have sufficient clearance from other work to finish at least 1/2 inch from other work or finished covering of other piping.
- C. Provide all necessary hangers, anchors, thrust blocks, etc., to properly support and protect piping system, as required by agencies listed under "REGULATIONS AND STANDARDS".
- D. Under no circumstances is the contractor to attach to or support from any bar joist bridging. Any supports to the bar joists or any structural systems are to be approved by the Architect/Engineer. All supplement angle or channel iron required to support equipment of this specification is to be furnished by the contractor and is to be independent of any other supports.

3.2 DESIGN:

- A. The sprinkler systems shall be designed as required for occupancies specified by experienced personnel have competency in the execution of such work. Sprinkler system design shall be performed only by licensed sprinkler contractors.
- B. Sprinkler piping shall be protected from freezing.
- C. NFPA rules and regulations governing the design shall be scrupulously adhered to.
- D. Piping shall be installed in accordance with NFPA 13.

3.3 EXECUTION:

- A. Run piping concealed above furred ceiling and in joists to minimize obstructions. Expose only heads.
- B. Coordinate sprinkler piping routing and heads with all trades.
- C. Protect sprinkler heads against mechanical injury.
- D. Include all costs of shop drawings review and approval from authorities in price.
- E. Locate outside alarm on wall of building adjacent to siamese department connections.

- F. Provide cabinet containing required number of spare heads as per NFPA 13, of each type, along with wrench suitable for each type of head.
- G. Provide flow switch on leaving side of main valve and monitoring switch on main valve. Flow switch shall sense flow and sound appropriate zone of fire alarm system monitoring switch on each main valve; when valve is started to its "closed" position shall indicate trouble on appropriate zone of fire alarm system and sound local audible alarm. Wiring between flow switches and monitoring switches and fire alarm system shall be provided under Division 16.
- H. Furnish and install sprinkler zone valves and flow switches where indicated on the drawings for the zoning of the system. Each of these devices shall be connected into the fire alarm system as indicated for the main valve, including local alarming.
- I. Provide all test and drain valves as required per NFPA 13.
- J. Support sprinkler piping in accordance with NFPA 13.
- K. Provide new water service as shown on the drawings.
- L. Install air compressor on vibration isolators, as required.
- M. Screw joint steel piping up to and including 1-1/2 inch diameter. Screw or Roll Goove 2 inch diameter and larger. PER NFPA 13.
- N. Die cut screw joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- O. Coat threaded ends with pipe lubricant compound.
- P. Steel piping, main sized saddle branch connections or direct connection of branch lines to mains is permitted if main is one pipe size larger than the branch for up to 6 inch mains and if main is two pipe sizes larger than branch for 8 inch and larger mains.
- Q. Solder Braze copper tubes.
- R. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 14 for standpipe and hose systems.
- S. Do not penetrate building structural members unless indicated.
- T. Provide sleeves when penetrating footings floors and walls.
- U. Seal pipe and sleeve penetration to achieve fire resistance equivalent to fire separation required.

3.4 INSTALLATION - VALVES:

- A. Install valves with stems upright or horizontal, not inverted.
- B. Provide gate valves for shut-off or isolating service.
- C. Where approved, butterfly valves may be used instead of gate valves.
- D. Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.5 SLEEVES AND PLATES:

- A. Wherever pipes pass through concrete slabs, furnish and install sleeves, properly located for the work.
- B. Use sleeves of sufficient size to allow the specified pipe covering to pass through the sleeves and finish sleeves flush with walls and ceiling.
- C. Sleeves shall be galvanized steel not lighter than 24 gauge.
- D. Seal spaces between sleeve and pipe. Use packing device or material for UL rating to match rating of wall or floor/ceiling as rated under UL File R9658.

3.6 ESCUTCHEONS:

- A. Where pipes passing through floors, walls or ceiling exposed to view in finished areas, provide pressed steel split plates which cover the opening and fit snugly to pipe.

3.7 COORDINATION:

- A. All interlock and signal wiring runs to the annunciator panel will be furnished and installed and as part of the Electrical Work.
- B. This contractor shall provide for all switches and interlocking devices on all valves as required.

3.8 UNDERGROUND PIPING:

- A. Underground fire protection system piping shall be installed in accordance with the requirements of NFPA 24, Private Fire Service Mains and Their Appurtenances. Provide concrete thrust blocking at each change of direction of the piping and at all tees, plugs, and caps in accordance with NFPA 24. Where thrust blocking is impractical, fittings with a mechanical joint retainer gland, approved for the piping material utilized, may be used in lieu of thrust blocking.

END OF SECTION 15300

DIVISION 15 - MECHANICAL
SECTION 15310 - WET-PIPE SPRINKLER SYSTEMS

PART 1.00 GENERAL

1.1 WORK INCLUDED:

- A. Installation of new sprinkler and related piping systems in new construction.

1.2 WORK INSTALLED BUT SPECIFIED UNDER OTHER SECTIONS

- A. Section 15300 - Fire Protection Piping: Piping and valves.

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS:

- A. Furnish sleeves to General Contractor.

1.4 RELATED WORK:

- A. Section 15140 - Supports and Anchors.
- B. Section 15242 - Vibration Isolation.

1.5 REFERENCES:

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volt maximum).
- B. NFPA 13 - Installation of Sprinkler Systems.

1.6 SYSTEM DESCRIPTION:

- A. System to provide coverage for entire new building area.
- B. Interface system with building control system. Building fire and smoke alarm system.
- C. Provide system per NFPA 13 hazard requirement.

1.7 QUALITY ASSURANCE:

- A. Design and installation to conform to NFPA 13.
- B. Equipment and components: Bear UL FM label or marking.
- C. Specialist Firm: Company specializing and licensed in sprinkler systems.

1.8 REGULATORY REQUIREMENTS:

- A. Hydraulic Calculations, Product Data, Shop Drawings: Bear stamp of approval of Fire Marshal.

- B. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.
- C. Submit shop drawings product data hydraulic calculations to Fire Marshal. Submit proof of approval to Architect. Include check for review fee with submittal to Fire Marshal's office.

1.9 PROJECT RECORD DOCUMENTS:

- A. Submit documents under provisions of Section 01700.

1.10 OPERATION AND MAINTENANCE DATA:

- A. Submit manufacturer's operation and maintenance data under provisions of Section 01700.
- B. Include written maintenance data on components of system, servicing requirements, and record drawings.
- C. Include maintenance, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.11 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver and store materials in shipping containers with labeling place under provisions of Section 01600.
- B. Provide suitable wrenches for each head type.
- C. Maintain caps in place until installation.

1.12 EXTRA STOCK:

- A. Provide extra sprinkler heads under provisions of NFPA 13 and Section 01700.
- B. Provide suitable wrenches for each head type.
- C. Provide storage cabinet, size and type as per NFPA-13

PART 2.00 PRODUCTS

2.1 PIPING MATERIALS:

- A. Above Ground Inside Building Piping: Pipe diameter smaller than and up to 2" shall be Steel Schedule 40 pipe, Pipe diameters 2-1/2" and larger shall be Steel Schedule 10 or Steel Schedule 40 pipe, As permitted by NFPA 13.

2.2 ACCEPTABLE MANUFACTURERS - SPRINKLER HEADS:

- A. Reliable Automatic Sprinkler
- B. Viking Corp.
- C. Tyco-Fire
- D. Substitutions: Under provisions of Instruction To Bidders, Page IB-3, Paragraph 4.3.

2.3 SPRINKLER HEADS:

- A. Exposed Area Type: Standard upright type with brass finish.
- B. Sidewall Type: Brass Chrome plated finish with matching escutcheon.
- C. Fusible Link: Temperature rated for specific area hazard.
- D. Guards: finish to match sprinkler head.
- E. Finished ceilings: Pendent sprinklers - concealed type with white cover plates. Unless otherwise noted on plans.

PART 3.00 EXECUTION

3.1 PREPARATION:

- A. Place pipe runs to minimize obstruction to other work.

3.2 INSTALLATION:

- A. Run piping concealed above furred ceiling and in joists to minimize obstructions. Expose only heads.
- B. Coordinate sprinkler piping routing and heads with all trades.
- C. Protect sprinkler heads against mechanical injury.
- D. Include all costs of shop drawings review and approval from authorities in price.
- E. Locate outside alarm on wall of building adjacent to siamese fire department connections.
- F. Provide cabinet containing required number of spare heads as per NFPA 13, of each type, along with wrench suitable for each type of head.
- G. Provide flow switch on leaving side of main valve and monitoring switch on main valve. Flow switch shall sense flow and sound appropriate zone of fire alarm system monitoring switch on each main valve; when valve is started to its "closed" position shall indicate trouble on

appropriate zone of fire alarm system and sound local audible alarm. Wiring between flow switches and monitoring switches and fire alarm system shall be provided under Division 16.

- H. Furnish and install sprinkler zone valves and flow switches where indicated on the drawings for the zoning of the system. Each of these devices shall be connected into the fire alarm system as indicated for the main valve, including local alarming.
- I. Provide all test and drain valves as required for system per NFPA 13.
- J. Support sprinkler piping in accordance with NFPA 13.
- K. Provide new water service as shown on the drawings.

3.3 CLEANING:

- A. Flush entire piping system of foreign matter.

3.4 SYSTEM TESTS:

- A. Hydrostatically test entire system.
- B. Test shall be witnessed by Fire Marshal and Architect.

END OF SECTION 15310

DIVISION 15 - MECHANICAL
SECTION 15410 - PLUMBING PIPING

PART 1.00 GENERAL

1.1 WORK INCLUDED

- A. Pipe and Pipe Fittings
- B. Valves
- C. Sanitary Sewer Piping System
- D. Domestic Water Piping system
- E. Service Connections
- F. Natural Gas Piping System

1.2 RELATED WORK

- A. Section 15000 - General Provisions
- B. Section 15121 - Expansion Compensation
- C. Section 15140 - Supports and Anchors
- D. Section 15260 - Piping Insulation
- E. Section 15430 - Plumbing Specialties
- F. Section 15440 - Plumbing Fixtures and Trim

1.3 REFERENCES:

- A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.
- B. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- D. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.
- E. ANSI/ASTM B32 - Solder Metal.
- F. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber

Gaskets.

- G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- H. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- I. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- J. ASTM B88 - Seamless Copper Water Tube.
- K. ASTM B306 - Copper Drainage Tube (DWV).
- L. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- M. AWS A5.8 - Brazing Filler Metal.
- N. AWWA C601 - Standard Methods for the Examination of Water and Waste Water.
- O. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary System.
- P. CISPI 310 – Standard for cast iron couplings
- Q. LSPC – The latest addition of the Louisiana State Plumbing Code.

1.4 QUALITY ASSURANCE:

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec. 9. ANSI/AWS D 1.1.
- D. Cast iron pipe and fittings shall be marked with CISPI's collective trademark.

1.5 SUBMITTALS:

- A. Submit shop drawings and product data under provisions of Section 01300.
- B. Include data on pipe material, pipe fittings, valves and accessories.

1.6 WATER PIPE AND FITTING MATERIALS STANDARD

- A. Plastic Water Pipe and Fittings
 - 1. ABS and PVC Plastic Tubular Fittings: ASTM F 409, ANSI/NSF 24, ANSI/NSF 14
 - 2. Joints for IPS PVC pipe using solvent cement: ASTM D 2672

3. Chlorinated poly (vinyl chloride) (CPVC) plastic pipe, Schedule 80, 2" and under: ASTM F 441, listed
4. Chlorinated poly (vinyl chloride) (CPVC) plastic pipe (SDR-PR): ASTM F 442
5. CPVC Pipe and fittings: ASTM D 2846, Listed
6. Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) pressure pipe and fittings: ASTM F 1281
7. Cross-linked Polyethylene (PEX) plastic hot and cold water distribution system: ASTM F 877, Listed
8. Cross-linked Polyethylene (PEX) tubing: ASTM F 876
9. Cross-linked Polyethylene (PEX) tubing systems for pressure: CAN/CSA-B137.5M89, listed
10. Flexible Elastomeric pressure joints: ASTM D 3139, See 308.8
11. Metal insert fittings for PB tubing: ASTM F 1380
12. Polyethylene/Aluminum/Polyethylene (PE-AL-PE) pressure pipe and fittings: ASTM F 1282
13. Polyethylene pipe and tubing (PE) Number 2305, 2306, 3306, 3406, 3408: ASTM D 2104, ASTM D 2239, ASTM D 2737, Listed, See 303.8.2
14. Poly (vinyl chloride) (PVC) plastic pipe fittings, Schedule 40: ASTM D 2466
15. Pressure rated ABS-fittings: ASTM D 2468, Listed
16. Pressure rated ABS-pipe Number 1210, 2112, 1316: ASTM D 1527, ASTM D 2282, Listed, See 303.8.2
17. PVC injection molded gasketed fittings for pressure applications: CAN/CSA-B137.2-M89, Listed
18. PVC Pipe, Number 1120, 1220: ASTM D 1785, ASTM D 2241, listed, See 303.8.2
19. PVC socket-type fittings, Schedule 80: ASTM D 2467, listed
20. Socket-type chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 80, 2" and under: ASTM F 439, listed
21. Threaded chlorinated poly (vinyl chloride) (CPVC) plastic pipe fittings, Schedule 80, 2" and under: ASTM F 437, listed

B. Ferrous Water Pipe and Fittings

1. Cast Iron fittings (threaded): ASTM A 126
2. Cast iron pipe (threaded): ANSI A40.5
3. Cast iron water pipe: ASTM A377
4. Ductile-iron water pipe: ANSI/AWWA C 151/A 21.51
5. Ductile-iron water fittings: ANSI/AWWA C 110/A 21.10
6. Malleable iron fittings (threaded): ASTM A 197
7. Nipples pipe (threaded): FS WW-N-351a
8. Stainless steel water pipe Grade H: ASTM A 268, See 303.8.4
9. Steel couplings, threaded, black and galvanized: ASTM A 865
10. Steel pipe black and galvanized: ASTM A 53
11. Welded and seamless steel pipe: ASTM A 53

C. NonFerrous Pipe and Fittings

1. Cast bronze fittings for flared copper tube: ANSI B16.26
2. Cast bronze threaded fittings: ASME B16.15
3. Cast bronze solder-joint pressure fittings: ANSI B16.18

4. Cast copper alloy fittings for flared copper tubes: ASME B 16.26
5. Pipe flanges and flanged fittings: ANSI B16.5
6. Seamless brass tube: ASTM B 135
7. Seamless copper pipe: ASTM B 42
8. Seamless copper tube: ASTM B 75
9. Seamless copper water tube types K, L, & M: ASTM B 88
10. Seamless red brass pipe: ASTM B 43
11. Seamless and welded copper distribution tube (type D): ASTM B 641
12. Threadless copper pipe (TP): ASTM B 302
13. Welded brass tube: ASTM B 587
14. Welded copper tube: ASTM B 447
15. Welded copper alloy UNS # C21000 water tube: ASTM B 642
16. Wrought copper and copper-alloy solder-joint pressure fittings: ASME B 16.22 for copper water tube
17. Wrought seamless copper and rectangular copper-alloy pipe and tube: ASTM B 251, square and tubing not applicable
18. Valves-flanged threaded, and welding end: ANSI B 16.34

D. Backflow Prevention Devices Materials Standard

1. Air gap standards: ASME A112.1.2
2. Backflow preventers, double check valve assembly: ASSE 1015, ANSI/AWWA C510
3. Backflow preventers with intermediate atmospheric vent: ANSI/ASSE 1012
4. Backflow preventers, double check detector assembly: ANSI/ASSE 1048
5. Backflow preventers, hose connection: ANSI/ASSE 1052
6. Backflow preventers, reduced pressure detector assembly: ANSI/ASSE 1047
7. Backflow preventers, reduced pressure principle assembly: ANSI/AWWA C511, ASSE 1013
8. Dual check valve type backflow preventer: ASSE 1032, for carbonated beverage dispensers-post mix type
9. Field test procedures for backflow preventer assemblies: ASSE 5010
10. Manual for the selection, installation, maintenance, and field testing of backflow prevention devices: CAN/CSA B64.10
11. Vacuum breakers, Anti-Siphon, pressure type assembly (outdoor use): ASSE 1020
12. Vacuum breakers-atmospheric pipe applied: ANSI/ASSE 1001
13. Vacuum breakers, back siphonage, pressure type assembly (spill resistant): ANSI/ASSE 1056
14. Vacuum breakers, hose connections: ANSI/ASSE 1011
15. Vacuum breakers, laboratory faucet: ANSI/ASSE 1035
16. Vacuum breaker wall hydrants, fronts resistant automatic draining: ASSE 1019
17. Water closet flush tank fill valves (ballcocks): ASSE 1002

E. Valves Material Standards

1. Valves, bronze gate: MSS SP-80
2. Valves, cast iron gate: ASTM A 126
3. Valves, ball: MSS SP-72, MSS SP-110
4. Valves, resilient-seated gate: ANSI/AWWA C509

- F. Temperature Control Device Standards
 - 1. Individual shower control valves, anti-scald: ASSE 1016
 - 2. Temperature actuated mixing valves for primary domestic use: ASSE 1017
 - 3. Water supply valves, mixing valves and single control mixing valves: ASSE 1029
- G. Potable Water Piping
 - 1. All potable water pipes, pipe related products, and materials that join or seal pipes conform to ANSI/NSF 61.

1.7 DRAINAGE SYSTEM MATERIALS STANDARDS

- A. NonMetallic Piping
 - 1. Concrete drain tile: ASTM C 412
 - 2. Concrete perforated: ASTM C 444
 - 3. Concrete reinforced culverts: ASTM C 76, for storm drains only
 - 4. Concrete reinforced sewer pipe: ASTM C 361, for storm drains only
 - 5. Concrete sewer pipe: ASTM C 14, for storm drains only
 - 6. Sewer manholes: ASTM C 478
 - 7. Concrete (steel cylinder type): FS SS-P-381
- B. Plastic Pipe and Fittings
 - 1. Coextruded composite pipe: ASTM F 1488, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, 1103.4
 - 2. Coextruded composite drain, waste, and vent pipe (DWV): ASTM F 1499, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, 1103.4
 - 3. Coextruded PVC plastic pipe: ASTM F 891, See 303.8.3, 303.8.5, 704.1, 1101.5, 1103.2, 1103.4
 - 4. Flexible elastomeric non-pressure joints: ASTM D 3212, See 303.8
 - 5. Large diameter ribbed PVC sewer pipe and fittings: CAN/CSA-B182.4
 - 6. Polyolefin laboratory drainage systems: CAN/CSA-B181.3
 - 7. PVC-DWV pipe and fittings: ASTM D 2665, listed, See 303.8.3
 - 8. Type PS 46 and type PS 115 sewer pipe (for outside building sewers, storm drains): ASTM F 789, See 704.1, 1101.4, 1103.2, 1103.4, ASTM D 2321, installation
 - 9. Type PSM PVC sewer pipe and fittings (for outside building sewers, storm drains, and storm sewers): ASTM 3034, See 704.1, 1101.5, 1103.2, 1103.4, ASTM D 2321, installation
 - 10. Type PSP PVC sewer pipe and fittings (for outside building sewers, storm drains, and storm sewers): ASTM D 2321, Installation
 - 11. All plastic piping pipes, plastic plumbing piping components and related materials shall be listed as conforming with ANSI/NSF Standard 14.
- C. Ferrous Pipe and Fittings
 - 1. Cast iron soil pipe and fittings: ASTM A 74, CISPI HS
 - 2. CI NO-HUB pipe and fittings: ASTM A 888, CISPI Std. 301
 - 3. Ductile-iron gravity sewer pipe: ASTM A 746
 - 4. Hubless cast iron sanitary system: CISPI Std. 310
 - 5. Manhole top frames and covers: ASTM A 48

- D. NonFerrous Pipe and Fittings
 - 1. Cast copper alloy solder-joint drainage fittings: ASME B 16.23, for plumbing drainage waste and vents
 - 2. Cast copper alloy solder-joint fittings for solvent drainage systems: ANSI B 16.32
 - 3. Copper drainage tube DWV: ASTM B 306
 - 4. Welded copper and copper alloy heat exchanger tube: ASTM B 543
 - 5. Wrought copper and wrought copper alloy solder-joint drainage fittings for plumbing drainage waste and vents: ASME B 16.29
 - 6. Wrought copper and wrought copper alloy solder-joint fittings for solvent drainage systems: ANSI B 16.43
- E. Glass pipe
 - 1. Borosilicate glass pipe and fittings for DWV applications: ASTM C 1053

PART 2.00 PRODUCTS

2.1 SANITARY SEWER PIPING AND STORM SEWER - BURIED BEYOND 5 FEET OF BUILDING:

- A. Schedule 40 PVC/DWV
Fittings: Same as piping
Joints: Solvent welded

2.2 SANITARY SEWER AND STORM SEWER PIPING - BURIED WITHIN 5 FEET OF BUILDING:

- A. Schedule 40 PVC/DWV
Fittings: Same as piping
Joints: Solvent welded

2.3 SANITARY SEWER AND STORM SEWER PIPING, ABOVE GRADE:

- A. Schedule 40 PVC/DWV
Fittings: Same as piping
Joints: Solvent welded

2.4 WATER PIPING, ABOVE GRADE: Exterior water piping buried beyond 5' of building to be same as above grade.

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
Fittings: ANSI/ASME B16.18, cast bronze solder-joint pressure fittings, or ANSI/ASME B16.22, wrought copper.
- B. All potable water pipes, pipe related products and materials that join or seal pipes and pipe related products shall be evaluated and listed as conforming with a national consensus product or material standard and ANSI/NSF Standard 61.

2.5 WATER PIPING, TRAP PRIMERS: Piping for trap primer piping below slab only.

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

2.6 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING:

- A. Polyethylene Pipe: ASTM D2513, SDR 11.5.
Fittings: ASTM D2683 to ASTM D2513, socket type.
Joints: Fusion welded.

2.7 NATURAL GAS PIPING, ABOVE GRADE:

- A. Steel Pipe: ASTM A53 or A120, Schedule 40, black.
Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type.
Joints: Screwed for pipe two (2) inches and under; ANSI/AWS D1.1 welded, for pipe over two (2) inches. All gas piping run in a concealed space shall be welded.

2.8 FLANGES, UNION, AND COUPLINGS:

- A. Pipe Size two (2) Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, solder joints.
- B. Pipe Size Over two (2) Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service.
- C. Dielectric Connections: Unions with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.9 GATE VALVES

- A. Up to two (2) Inches: Bronze body, non-rising or rising stem and handwheel, inside screw, single double wedge or disc, solder or threaded ends. Nibco Model 113 Series, Crane Model 438 Series, Powell Model 2700, Hammond 2B 617 or approved equal.
- B. Over two (2) Inches: Iron body, bronze trim, non-rising or rising stem and handwheel, OS&Y, single wedge, flanged ends. Red and White 415/421, NIBCO F619/F617, Crane 461/465 1/2 or approved equal.

2.10 GLOBE VALVES:

- A. Up to 2 Inches: Bronze body, rising stem and handwheel inside screw, renewable composition disc, solder screwed ends, with backseating capacity. Nibco Model 211 Series, Crane Model 1 Series, Powell Model 150, Hammond 1.413, Red White 211/212 or approved equal.
- B. Over 2 Inches: Iron body, bronze trim, rising stem and handwheel, OS&Y, plug-type disc, flanged ends. Red and White Fig 400 or NIBCO F718-B, Crane 351 or approved equal.

2.11 BALL VALVES:

- A. Up to 2 Inches: Bronze or stainless steel body, stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, solder threaded ends with union. Nibco Model 580 Series, Crane Model 2330 Series, Red White 5092/5095 or approved equal.
- B. Over 2 inches: Cast steel body, chrome plated steel ball teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 10 inches and over, flanged.

2.12 BUTTERFLY VALVES:

- A. Iron body, bronze disc, resilient replaceable seat for service to 180-degrees F, or lug end butterfly, 10 position over handle or infinite position lever handle with memory stop.

2.13 SWING CHECK VALVES:

- A. Up to 2 inches: Bronze 45 degree swing disc, solder or screwed ends. Nibco Model 413 Series, Crane Model 37 Series, Red White 236/237 or approved equal.
- B. Over 2 inches: Iron body, bronze trim, 45 degrees swing disc, renewable disc and seat, flanged ends. Red White 435, Nibco F918, Crane 373 or approved equal.

2.14 SPRING LOADED CHECK VALVES:

- A. Iron body, bronze trim, spring loaded, bronze disc, wafer.
- B. Red White 442, Nibco W920W, Stockham W6-970 or approved equal.

PART 3.00 EXECUTION

3.1 PREPARATION:

- A. Ream pipe and tube ends. Remove burrs. Bevel end Ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATIONS:

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.

- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Provide access where valves and fittings are not exposed.
- H. Slope water piping and arrange to drain at low points.
- I. Establish elevations of buried piping outside the building to insure not less than 3 feet of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
- L. Establish invert elevations, slope all drainage piping 4 inches and larger to 1/8 inch per foot minimum. All drainage piping 3 inches and smaller shall be sloped to 1/4 inch per foot minimum.
- M. Install bell and spigot pipe with bell end upstream.
- N. Install valves with stems upright or horizontal, not inverted.
- O. Provide one plug cock wrench for every ten plug cocks sized 2 inches and smaller, minimum of one. Provide one plug cock wrench for each plug cock sized 2-1/2 inches and larger.
- P. In pipe 3 – inch nominal diameter or less, cleanouts shall be located at not more than 50ft.intervals
- Q. In pipe 4 – inches nominal diameter through 6 inches nominal diameter, cleanouts shall be located at not more than 80ft. intervals
- R. Each building drain shall be provided with a cleanout within 6ft. of the junction of the building drain and building sewer.

3.3 APPLICATION:

- A. Grooved mechanical couplings and fasteners not allowed.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe. All joints in potable lines to be lead free.
- D. Install gate, ball, butterfly valves for shut-off and to isolate equipment, part of systems, or

vertical risers.

- E. Install globe, ball, butterfly valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.

3.4 TEST

- A. Upon completion of the domestic water piping system, it shall be tested and proved tight under a water pressure not less than 200 psi. The water used for testing shall be obtained from a potable source of supply. This pressure test shall be performed before the disinfection of the domestic water piping system is started. This test shall conform to the Louisiana State Plumbing Code
- B. Upon completion of the sanitary sewer piping system the contractor shall perform a water test to prove that the system is tight and without leaks. No section of the piping system shall be tested with less than 10 ft head of water. The pressure shall be kept on the system for a time no less than 1 hour. This test shall conform to the Louisiana State Plumbing Code.
- C. Upon completion of the sanitary vent piping system the contractor shall perform a pressure test to prove that the system is tight and without leaks. This test shall conform to the Louisiana State Plumbing Code.
- D. All Gas piping shall be tested in accordance to NFPA 54.
- E. Prior to any test, the contractor shall notify the Architect in writing a minimum of 5 business days, the date and time the test will take place. No exceptions. After the completion of the test but before the building is substantially complete the contractor shall submit a written report with the following information for each test performed.
 - 1. Project Name
 - 2. Project Location
 - 3. Plumbing Contractor Name, Address and Contact Information
 - 4. Identification of test performed.
 - 5. Time and Date test was started
 - 6. Time and Date test was completed.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM:

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Option 1: The system shall be filled with a solution containing 50 ppm of available chlorine and allowed to stand 6 hours before flushing and returning to service.
- C. Option 2: The system shall be filled with a solution containing 100 ppm of available chlorine and allowed to stand 2 hours before flushing and returning to service.
- D. Prior to the disinfection of the domestic water piping system the contractor shall inform the

architect in writing the date and time the disinfection will take place. After the completion of the disinfection of the domestic water piping system but before the building is substantially completed the contractor shall submit a written report with the following information.

1. Project Name
2. Project Location
3. Plumbing Contractors Name, Address, and contact information
4. Chemicals used in the disinfection process.
5. Time and Date disinfection process was started
6. Time and Date disinfection process was completed

3.6 SERVICE CONNECTIONS:

- A. Provide new sanitary and storm sewer services and tie into existing as shown on plans. Before commencing work check invert elevations required for sewer connections, confirm inverts and insure that these can be properly connected with slope for drainage and cover to avoid freezing. Contractor to tie in existing services as shown on drawings.
- B. Tie domestic water into existing services as shown on drawings. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Provide 18-gauge galvanized sheet metal sleeve around service main to 6 inches above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing. Contractor shall utilize and tie in existing water lines as indicated on the drawings.
- C. Tie new gas service into existing onsite. Coordinate connection with gas service provider.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15430 - PLUMBING SPECIALTIES

PART 1.00 GENERAL

1.1 WORK INCLUDED

- A. Floor drains
- B. Trap Primers
- C. Roof Drains
- D. Cleanouts
- E. Backflow preventors
- F. Water hammer arrestors
- G. Hose bibbs hydrants

1.2 RELATED WORK

- A. Section 15140 - Supports and Anchors
- B. Section 15410 - Plumbing Piping
- C. Section 15440 - Plumbing Fixtures

1.3 REFERENCES

- A. ANSI/ASSE 1012 - Backflow Preventers with immediate Atmospheric Cent.
- B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
- C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- E. ANSI A112.21.1 - Roof Drains
- F. ANSI A112.26.1 - Water Hammer Arrestors
- G. PDI WH-201 Water Hammer Arrestors

1.4 QUALITY ASSURANCE

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.5 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01300.
- B. Include component sizes, rough-in requirements, service sizes, and finishes.

PART 2.00 PRODUCTS

2.1 FLOOR DRAINS

- A. Floor Drain (FD): ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, square adjustable nickel- bronze strainer, and trap primer connection; Wade model 1100G, Zurn model Z415s or Smith model 2005.
- B. All floor drains installed shall have trap primers.

2.2 TRAP PRIMERS

- A. Trap primers shall be PPP, Inc. Prime-Rite 500 with AG-500 air gap fitting. Distribution unit may be used for multiple floor drains. Trap primers shall be installed as per manufacturer recommendations and in strict accordance with the Louisiana Plumbing Code. Proper air gap shall be maintained between the trap primer and the domestic water supply. Elastomeric flexible type trap guards will not be allowed on this project.

2.3 ROOF DRAINS

- A. Roof Drains (RD): Duco Cast Iron body with adjustable extension sleeve, reversible collar, combined flashing clamp, under deck clamp, and gravel stop, with cast iron dome. Coordinate outlet with storm sewer piping. Wade model 3000-ADF, Zurn model Z100, or Smith model 1015.

2.4 EMERGENCY ROOF DRAIN

- A. Emergency roof drain (ERD): Duco cast iron body with adjustable extension sleeve, 2" high combination membrane flashing clamp/gravel guard with cast iron dome drain. Coordinate outlet size with storm sewer piping. Zurn Z-100, Wade, or Smith.

2.5 FLOOR SINK

- A. Floor sink (FS): 12"x12" floor sink with square nickel bronze top, 8" deep, aluminum dome strainer. Zurn Z1901, Wade 9144, or Smith 300.

2.6 CLEANOUTS

- A. Exterior Surfaced Areas: As detailed on Plans.
- B. Interior Finished Floor Areas: Lacquered cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel- bronze strainer, square with scoriated cover in service areas and square with depressed cover to accept floor finish in finished floor areas; Model W-6000 manufactured by Wade or Model ZN-1400 manufactured by Zurn or 4000 Series manufactured by Smith.
- C. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketted cover, and round stainless steel access cover secured with machine screw; Model W-8460-R manufactured by Wade or Model ZN-1445-1 manufactured by Zurn or Model 4532 manufactured by Smith.
- D. Interior Unfinished Accessible Areas: Caulked or threaded type, provide bolted stack cleanouts on vertical rainwater leaders.
- E. Acceptable Manufacturers
 - 1. Wade 6000
 - 2. Zurn 1400
 - 3. Substitutions: Under provisions of Instructions To Bidders.

2.7 BACKFLOW PREVENTERS FOR DOMESTICE WATER

- A. Pressure Backflow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and Stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
- B. Acceptable Manufacturers
 - 1. Watts Model 909
 - 2. Wilkins Model 375
 - 3. Substitutions: Under provisions of Instructions To Bidders.

2.8 REDUCED-PRESSURE-DETECTOR, FIRE-PROTECTION, BACKFLOW-PREVENTER ASSEMBLIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Ames Fire & Waterworks; a Watts Water Technologies Company
 - 2. FEBCO; a Watts Water Technologies Company
 - 3. Watts Regulator; a Watts Water Technologies Company
 - 4. Substitutions: Under provisions of Instructions To Bidders
- B. Standard: ASSE 1047 and is FM Global approved or UL listed.
- C. Operation: Continuous-pressure applications.

- D. Pressure Loss: 12 psig maximum, through middle third of flow range.
- E. Body: Cast iron with interior lining that complies with AWWA C550 or that is FDA approved.
- F. End Connections: Flanged.
- G. Configuration: Designed for vertical-inlet, horizontal-center-section, and vertical-outlet flow.
- H. Accessories:
 - 1. Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - 2. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
 - 3. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.9 WATER HAMMER ARRESTORS

- A. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range - 100 to 300 degrees F (-73 to 49 Degrees C) and maximum 250 psig (1700 kpa) working pressure.
- B. Acceptable Manufactures
 - 1. Wade Model W-5, W-10, W-20
 - 2. Zurn Model Z-1700-100, 200, 300
 - 3. Smith Model 5000
 - 4. Substitutions: Under provisions of Instructions To Bidders.

PART 3.00 EXECUTION

3.1 PREPARATION

- A. Coordinate cutting forming of roof floor construction to receive drains to required invert elevations.

3.2 INSTALLATION AND APPLICATION

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Insure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.

- D. Install water hammer arrestors complete with accessible isolation valve.
- E. In pipe 3 – inch nominal diameter or less, cleanouts shall be located at not more than 50ft.intervals
- F. In pipe 4 – inches nominal diameter through 6 inches nominal diameter, cleanouts shall be located at not more than 80ft. intervals
- G. Each building drain shall be provided with a cleanout within 6ft. of the junction of the building drain and building sewer.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15440 - PLUMBING FIXTURES AND TRIM

PART 1.00 GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Fixtures and Trim

1.2 RELATED WORK

- A. Section 15000 - General Mechanical
- B. Section 15410 - Plumbing Piping
- C. Section 15430 - Plumbing Specialties

1.3 SUBMITTALS

- A. Furnish and install plumbing fixtures as shown on the accompanying drawing and in accordance with the approved rough-in drawings. This will include service sinks, lavatories, water closets, urinals, etc., with all brass in connection with supply tubing, traps, escutcheons, stop and basin cocks, etc. All fixtures shall be new and must be delivered to the building properly crated and in perfect condition.
- B. All brass must be best quality. All brass pipe to be seamless brass tubing and all fixture traps shall be heavy with C.O. plugs. Nipples shall be extra heavy. Lightweight goods will not be accepted. All exposed metal on fixtures shall be C.P. or Chromard. All "P" traps shall be complete with cleanout plug.
- C. Contractor shall submit in his fixture brochure for approval, a rough-in sheet of each fixture and indicate any variation required for the fixtures. Fixtures are to be roughed-in in accordance with these approved rough-in sheets and anchored so that piping cannot be moved.

1.4 JOB CONDITIONS

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

PART 2.00 PRODUCTS – see plans

PART 3.00 EXECUTION

3.1 INSTALLATION

- A. Install furnish and install all plumbing fixtures and accessories according to manufacturer's instruction and according to national, state and local codes governing the various systems.

Carefully review the Architectural floor plans and millwork details to determine exact number of all fixtures, outlets, accessories required and exact mounting height. Contractor shall verify any and all electrical requirements prior to ordering equipment. Coordinate all fixtures, outlets, drains, accessories, etc., prior to submitting shop drawings.

- B. Install each fixture in accordance with rough-in drawings as per manufacturers recommendations. At completion thoroughly clean plumbing fixtures and equipment. Anchor fixtures rigidly; anchor piping in walls so that piping cannot be moved.
- C. Provide chrome plated rigid or flexible supplies to fixtures with stops, reducers and escutcheons.
- D. Solidly attach floor water closets to floor with lag screws and finishing caps.
- E. Install each fixture with trap, easily removable for servicing and cleaning.
- F. All fixtures supplied with domestic water, hot or cold, shall be installed with integral stops on all supply lines.
- G. Mount fixtures to the following heights above finished floor:
 - 1. Water Closets:
 - a. Standard 15" to top of bowl rim
 - b. Handicapped 18" to top of seat
 - 2. Urinal:
 - a. Standard 22" to top of bowl rim
 - 3. Lavatories:
 - a. Handicapped 34" to top of basin rim
 - 4. Water Closet Flush Valves:
 - a. Standard 11" min. above bowl rim
- H. Contractor shall caulk all joints at walls and floors with plumbing fixtures.
- I. Contractor shall provide approved ADA drain and water line insulation covers on all exposed services for lavatories and sinks. Truebro Lav Guard or approved equal.

3.2 FIXTURE ROUGH-IN SCHEDULE:

- A. Rough-in fixture piping and size connections shall be in accordance with the following table of minimum sizes for particular fixtures unless noted different on the drawing:

PLUMBING FIXTURE ROUGH-IN SCHEDULE

=====				
<u>DESCRIPTION</u>	<u>C.W.</u>	<u>H.W.</u>	<u>WASTE</u>	<u>VENT</u>

WATER CLOSET (TANK)	1/2"	—	4"	3"
WATER CLOSET (FLUSH VALVE)	1"	--	4"	3"
URINAL (FLUSH VALVE)	3/4"	--	2"	1-1/2"
LAVATORY	1/2"	--	2"	1-1/2"
SERVICE SINK	1/2"	1/2"	3"	2"
ELECTRIC WATER COOLER	1/2"	--	2"	1-1/2"
SINK	1/2"	1/2"	2"	1-1/2"
HOSE BIBB	3/4"	--	--	--
2" FLOOR DRAIN	--	--	2"	1-1/2"
3" FLOOR DRAIN	--	--	3"	2"
3" HUB DRAIN	--	--	3"	2"

WATER PIPE SIZING TABLE

UNLESS SHOWN OTHERWISE, DOMESTIC WATER LINES SHALL RUN CONCEALED OVERHEAD AS DESIGNATED IN PLUMBING FIXTURE SCHEDULE AND BE SIZED ACCORDING TO TABLE BELOW.

PLANS AND RISER DIAGRAMS DO NOT NECESSARILY SHOW ALL PIPING RUNS. INSTALL A FACTORY SHOCK ABSORBER AT TOP OF EACH FIXTURE GROUP AND ALSO AT WATER HEATERS.

<u>NUMBER OF FIXTURES*</u>	<u>PIPE SIZE (IPS)</u>
2 OR LESS	1/2"
3 TO 5	3/4"
6 TO 10	1"
11 TO 15	1-1/4"
16 TO 28	1-1/2"

*FLUSH VALVE WATER CLOSET IS EQUIVALENT TO SIX (6) FIXTURES SIZES INDICATED ABOVE ARE MINIMUM SIZES TO BE USED UNLESS OTHERWISE STATED

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15624 - FORCED AIR FURNACE - ELECTRIC HEAT - DX

PART 1.00 GENERAL

1.01 WORK INCLUDED

- A. Forced Air Furnace
- B. Refrigeration Cooling Coil
- C. Controls
- D. Electric Heater

1.02 RELATED WORK

- A. General Mechanical
- B. Supports and Anchors
- C. Piping Insulation
- D. Air Cooled Condensing Unit
- E. Ductwork

1.03 QUALITY ASSURANCE

- A. Conform to requirements of UL and applicable codes.
- B. Cooling system tested and rated to ARI Standard 210.

1.04 SUBMITTALS

- A. Submit manufacturer's installation instructions.
- B. Submit manufacturer's descriptive literature, operating instruction, and maintenance and repair data.

PART 2.00 PRODUCTS

2.01 TYPE

- A. Provide horizontal type with electric heating elements.
- B. Provide self contained packaged, factory assembled, pre-wired units, consisting of cabinets, supply fan, controls, air filter, refrigerant cooling coil.

2.02 PERFORMANCE

- A. Refer to Schedule of Drawings for performance and capacities.

2.03 CONSTRUCTION

- A. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation.
- B. Fan: Direct or belt drive (as scheduled), rubber isolated mounted 1750 rpm motor.
- C. Air Filters: One (1) inch thick glass fiber, disposable type arranged for easy replacement.

2.04 ELECTRIC HEATER

- A. Finned tube metal sheath heating elements or open coil type (black heat) arranged in incremental stages as scheduled, accessible, with protection against no or low air flows, shorts or grounds, and failure of protection devices.

2.05 ELECTRIC HEATER CONTROLS

- A. Unit to be complete with low voltage transformer, terminal box with built-in factory wired magnetic contactors and high temperature thermal cutout protection with magnetic contactors rated for 100,000 cycle service: electric heating coils to be protected as per Article 424 of National Electric Code, UL approved and so labeled.

2.06 EVAPORATOR COIL

- A. Mount in furnace supply plenum, copper tube with mechanically bonded aluminum fins in a coil assembly, with galvanized drain pan, drain connection, and refrigerant piping connections.
- B. Provide factory installed thermostatic expansion valve.

2.07 CONTROLS

- A. Temperature control sequence of air conditioning equipment: "Automatic controls are placed into operation when system is energized. Provide room type thermostat to cycle condensing unit on the cooling cycle and the electric heater strip on the heating cycle as required to maintain space conditions. Air handling unit fan shall be wired for constant fan operation and shall be electrically interlocked such that the condensing unit may not run nor the electric heater strip be energized unless the evaporator fan is running. An air switch shall be installed which shall prevent electric heater operation until air flow is proven. If return air temperature rises above firestat setpoint then the firestat (located in the return air plenum) shall de-energize the air handling unit fan(s). If supply air contains smoke, a smoke detector (located in the supply air plenum) shall de-energize the air handling unit fan(s). If auxiliary drain pan fills with water, a float switch shall de-energize the condensing unit."

- B. Contractor shall provide clear locking cover for all thermostats.

2.08 ACCEPTABLE MANUFACTURERS

- A. TRANE COMPANY
- B. YORK INTERNATIONAL
- C. LENNOX INDUSTRIES

PART 3.00 EXECUTION

3.01 INSTALLATION

- A. Install in strict accordance with manufacturer's recommendations.
- B. Pipe condensate drain as shown on the drawings or to the nearest available plumbing vent.

END OF SECTION

DIVISION 15 – MECHANICAL
SECTION 15671 - AIR COOLED CONDENSING UNIT

PART 1.00 GENERAL

1.1 WORK INCLUDED

- A. Condensing Unit Package
- B. Internal Piping and Accessories
- C. Controls

1.2 RELATED WORK

- A. Section 15000: General Mechanical
- B. Section 15140: Supports and Anchors
- C. Section 15170: Motors
- D. Section 15190: Mechanical Identification
- E. Section 15623: Forced Air Furnace - Electric - DX

1.3 QUALITY ASSURANCE

- A. Conform to requirements of UL and applicable codes.
- B. Test and rate cooling system to ARI Standard 210.

1.4 SUBMITTALS

- A. Submit shop drawings and product data.
- B. Submit with shop drawings, schematic layouts showing condensing units, cooling coils, refrigerant piping, size, and accessories required for complete system.
- C. Submit manufacturer's installation instructions.

PART 2.00 PRODUCTS

2.1 TYPE AND PERFORMANCE

- A. Provide self-contained, package, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil(s) and fan(s), integral sub-cooling coil, controls, liquid receiver, and screen(s).
- B. All Condensing Unit's to be supplied with coil guards.
- C. Refer to Schedule on Drawings for air cooled condensing unit(s) requirements.
- D. Acceptable Manufacturer: TRANE COMPANY; YORK INTERNATIONAL; LENNOX

INDUSTRIES

2.2 MATERIALS

- A. Use corrosion resistant materials for parts in contact with refrigerant. Provide timer circuits to prevent rapid loading and unloading of compressor.

2.3 CABINET

- A. Galvanized steel with baked enamel finish, and removable access doors or panels with quick fasteners.

2.4 COMPRESSOR(S)

- A. Provide hermetically sealed, 1750 rpm resiliently mounted compressor with positive lubrication, crankcase heater, cylinder unloaders for capacity modulation (as scheduled), motor overload protection, service valves, filter driers (suction and liquid), and sight glass.

2.5 CONDENSER

- A. Coil: Seamless copper tube with mechanically bonded aluminum fins.
- B. Fans: Vertical discharge, direct or belt drive axial fan(s), resiliently mounted with guard and motor.
- C. Motors: Permanently lubricated ball bearing motors with built-in current and overload protection.

2.6 CONTROLS

- A. Provide high and low pressure cutouts for compressor, oil pressure control, and reset relay.
- B. Provide controls to permit operation down to 50-degrees F. ambient temperature at minimum compressor load.
- C. Provide programmable Digital Thermostats.

2.7 REFRIGERANT PIPING

- A. Refrigerant piping shall be run in Type "L" hard drawn copper tubing attached with wrought copper fittings, utilizing 1000-degree silver solder and a non-corrosive flux. Refrigerant piping shall be sized and installed in strict accordance with the air conditioning unit manufacturer's recommendations and directions and shall be submitted to the Engineer for prior approval before installation. Pressure drops shall not exceed the equivalent of 2-psi. Refrigerant piping system shall be evacuated, charged with refrigerant holding charge. The refrigerant lines to be tested with nitrogen to a test pressure of not less than 450 psi and proved before final charge of refrigerant. Compressor shall not be subject to the 450 psi pressure test.
- B. All refrigerant piping shall comply with the applicable requirements of the safety Code of Mechanical Refrigeration (ASA-89.1-1956) and the Code of Refrigerant Piping (ASA-

831.5-1962), and all state ordinances, codes, and regulations.

- C. Refrigerant suction line shall be insulated with cellular foam type insulation; "K" value of 0.28 at 75-degrees F. Manufacturers: Armstrong "Armaflex" or Rubatex R-180-FS.

PART 3.00 EXECUTION

3.1 INSTALLATION

- A. Complete structural, mechanical and electrical connections in accordance with manufacturer's installation instructions.
- B. Mount unit on 4" concrete pad with minimum 6" clearance all around or as indicated on the drawings.
- C. Furnish charge of refrigerant and oil.

3.2 START-UP AND TESTING

- A. Dehydrate, charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

3.3 GUARANTEE

- A. Reciprocating refrigerant compressor shall have full five (5) year warranty.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15890 - DUCTWORK

PART 1.00 GENERAL

1.01 WORK INCLUDED

- A. Low pressure duct.
- B. Fire and Smoke Dampers

1.02 RELATED WORK

- A. Section 15140 - Supports and Anchors
- B. Section 15260 - Piping and Equipment Insulation
- C. Section 15930 - Air Terminal Units
- D. Section 15936 - Air Inlets and Outlets
- E. Section 15954 - Testing and Balance

1.03 REFERENCES

- A. ASHRAE, 2009 Fundamentals, Chapter 21.
- B. ASHRAE, 2008 Equipment, Chapter 18.
- C. NFPA 90A, 90B.
- D. H.V.A.C. Duct Construction Standards - SMACNA 1995.

1.04 DEFINITIONS

- A. Duct sizes: All duct sizes are indicated on the plans as metal to metal.
- B. Low Pressure: Three pressure classifications: 1/2" WG positive or negative static pressure and velocities less than 2,000 fpm, 1" WG positive or negative static pressure and velocities less than 2,500 fpm and 2" WG positive or negative static pressure.
- C. Medium Pressure: Three pressure classifications: 3 inch WG positive or negative static pressure and velocities less than 4,000 fpm, 4" WG positive static pressure and velocities greater than 2,000 fpm. 6" WG positive static pressure and velocities greater than 2,000 fpm.

1.05 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and NFPA 90B Standards.

- B. Store and protect products under provisions of Section 01600.
- C. Construct ductwork to International Mechanical Code Standards

PART 2.00 PRODUCTS

2.01 LOW PRESSURE DUCTWORK

- A. Furnish and install all ducts for the air conditioning, heating and ventilating systems. Ductwork shall be complete with grilles, vanes splitters, flashings, hangers, flexible connections, manual dampers, fresh air inlet louvers, reinforcing angles, transitions to equipment, etc.
- B. All low pressure ductwork (mean velocity less than 2,000 FPM and static pressure in duct 2" of water or less) shall be constructed as per SMACNA Standards, 1995 Edition, Chapter 1, and shall be of the gauge metal and reinforced as per SMACNA Standards, 1995 Edition.
- C. Flashing shall be of the same material as specified under the roofing and flashing section of these specifications, or of 16-ounce sheet copper and shall be furnished and installed around all outside openings used for ducts or fans where required. Roof flashing shall extend at least 8" above roof. Cooperate with roofing contractor when installing flashing.
- D. All duct connections to equipment shall be made with fire and mildew resistant flexible connections of canvas or other acceptable materials. Connections shall have suitable metal collar frames at each end and shall not be less than 4" long with at least 1" of slack in the connection. Flexible connections shall be heat resistant to 500 degrees F continuously.
- E. Duct dimensions shown are metal sizes. All edges shall be straight and true.
- F. All flexible connections, duct liner and adhesives shall be U.L. listed as having a maximum flame spread of 50, fuel contribution of 25 and smoke contribution of 25.
- G. This Contractor shall furnish and install in ductwork all dampers, vanes splitters, etc.. as shown on the drawings or necessary to make the system complete. Where dampers or splitters can not be accessed through lay in ceiling, Contractor shall provide lockable 24" x 24" access door. Contractor shall coordinate location with Architect.
- H. Shafts shall be marked to show position of dampers, vanes, splitters, etc.
- I. Ductwork shall be supported in accordance with SMACNA Plate No. 17 and No. 18, up to and including band iron hangers attached to duct by means of screws or rivets per hanger.
- J. Access doors shall be provided in ductwork for all automatic dampers and each manual damper 3 square feet in area or larger, and shall be so located that damper can be completely serviced through the access door. Access door shall be provided with felt gaskets and suitable hinges and locks. Where access doors occur in insulated duct, double skin insulated doors shall be used.
- K. Where square ducts are shown, provide single vane elbows as per Plate 22, Figure A, SMACNA Standards, 1995 Edition. For all ductwork over 18" provide double vane square elbow as shown in Figure C of the Plate.

- L. All low pressure ductwork joints shall be sealed with hard cast "iron grip".
- M. Flexible air duct for connections between low pressure rectangular duct and ceiling diffusers shall be pre- insulated and listed by Underwriters Laboratories under U.L Standard 181 as a Class 1 flexible air duct and complying with NFPA Standards 90A and 90B.
- N. All flex duct 45 degree and 90 degree turns shall be metal hard duct.

2.02 INSULATED ACOUSTICAL LOW PRESSURE FLEXIBLE DUCT

- A. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel.
- B. Provide where indicated on drawings Flexmaster Type 8M UL181 Class I Air Duct.
- C. Fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.
- D. The internal working pressure rating shall be at least 6" w.g. positive and 4" w.g. negative with a bursting pressure of at least 2½ time the working pressure.
- E. The duct shall be rated for a velocity of at least 4000 feet per minute.
- F. The duct must be suitable for continuous operation at a temperature range of -20° F to +250°
- G. Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council's Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM 477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	7	31	40	38	40	27
8" diameter	13	29	36	35	38	22
12" diameter	21	28	29	33	26	12

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be at least:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	5	8	7	8	11	15

8" diameter	10	7	7	8	10	13
12" diameter	9	6	6	5	9	13

The self generated sound power levels (LW) dB re 10^{-12} Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	54	45	38	31	27	23

Factory insulate the flexible duct with fiberglass insulation. The R value shall be at least 5.0 at a mean temperature of 75° F. (R-4.2 is not acceptable)

H. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure A.

J. Maximum length to be 6'-0

ALL FLEX CONNECTIONS TO CEILING DIFFUSERS MUST BE FACTORY DESIGNED TO HAVE NO DIMENSIONAL CONTORTION WHEN CONNECTED TO THE DIFFUSER. A HARD METAL 90-DEGREE ELBOW OR A PLASTIC "CRUTCH" ELBOW IS REQUIRED FOR OTHER FLEX DUCTS THAT MAY BE SUPPLIED

2.03 FIRE AND SMOKE DAMPERS

A. Round and oval fire dampers shall be designed for high pressure duct systems.

B. Rectangular fire dampers shall be designed for low pressure duct systems.

C. All fire dampers must be NFPA 90A and UL approved.

D. Furnish and install access doors in ductwork, walls, and ceilings where required to service all fire dampers, smoke dampers and detectors. All fire and smoke dampers shall be installed by the sheet metal contractor. All smoke detectors shall be furnished by the electrical Sub-contractor. Control of smoke dampers shall be coordinated with fire alarm system and building automation system.

E. Rectangular Smoke Dampers - Louvers Dampers Inc. Model SD-400-UD or Ruskin FSD-35 tight seal parallel blade smoke dampers with low leakage and felted blades.

F. Round and Oval Smoke Dampers - Shall be same as above but complete with welded round or oval collars. Units shall be capable of handling pressures up to 6" W.G.

- G. Smoke dampers shall be Class I rated as per UL 555.
- H. Sheet metal contractor shall provide and install all smoke dampers and actuators. Dampers shall be provided with end switches
- I. Approved Manufacturers: Pottorff, Ruskin, Price, Nailor Industries, Greenheck, or prior approved equal.

2.04 LOW LOSS TAP

- A. All round low pressure connections to rectangular ducts shall be made with a factory fabricated 45 degree low loss entry "shoe" tap with damper constructed of minimum 26 gage galvanized steel. The damper shall have a 2" raised handle with a high quality locking quadrant. A 3/8" continuous rod with "U" bolts connects the damper to the rod. Nylon end bearings are required where the rod penetrates the spin collar barrel.
- B. Provide Flexmaster #STOD-BO3, Dace # 26 ga STOD-C03, or prior approved equal.
- C. For medium pressure systems where used upstream of VAV terminals, the damper can be eliminated (use Flexmaster #STO or Dace 24 ga STO). Gauge shall be 24 gauge on medium pressure systems.

PART 3.00 EXECUTION

3.01 INSTALLATION

- A. See details of ductwork symbols and connections on drawing.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15936 - AIR OUTLETS AND INLETS

PART 1.00 GENERAL

1.01 WORK INCLUDED

- A. Diffuser boots.
- B. Registers/grilles.
- C. Louvers.

1.02 RELATED WORK

- A. See Mechanical Plans for wall louvers.

1.03 REFERENCES

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. AMCA 500 - Test Method for Louvers, Dampers, and Shutters.
- C. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- D. ARI 650 - Air Outlets and Inlets.
- E. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- F. SMACNA - Low Pressure Duct Construction Standard.

1.04 QUALITY ASSURANCE

- A. Test and rate performance of air outlets and inlets in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate performance of louvers in accordance with AMCA 500.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/NFPA 90A.

1.06 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01300.
- B. Provide product data for items required for this project.
- C. Submit schedule of outlets and inlets indicating type, size, application, and noise level.

- D. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data and schedules of outlets and inlets.
- E. Submit diffuser, grille and register color data to Architect for approval.

PART 2.00 PRODUCTS

2.01 GENERAL

- A. See mechanical schedules and drawings for diffuser types, sizes and configuration. See architectural plans - room finish schedules for type of ceiling and wall construction.
- B. Substitutions: Under provisions of Instructions To Bidders, Page IB-3, Paragraph 4.3.

2.02 ACCEPTABLE MANUFACTURERS - Ceiling Diffusers

- A. Titus TMSA Series, Krueger Series 1400 Adjustable
- B. All diffusers shall have opposed blade volume dampers and adjustable horizontal to vertical four way throw operable from face of grille. All diffusers must be aluminum.

2.03 ACCEPTABLE MANUFACTURERS - Ceiling Exhaust Grilles

- A. Titus - Model 50F Code C 1/2" x 1/2" x 1" Cube Core, Krueger EGC-10, Nailor Industries Model 51EC
- B. All exhaust registers shall have opposed blade dampers.
- C. Grilles shall have baked enamel white finish.
- D. All dampers shall be operable from grille face.

2.04 ACCEPTABLE MANUFACTURERS - Ceiling Return Air Grilles

- A. Titus - 50F Code C, Krueger EGC-10, Nailor Industries
- B. All return air shall have opposed blade dampers. See plans for filter backed grille requirements.

2.05 ACCEPTABLE MANUFACTURERS - Wall Supply Registers.

- A. Titus 1700 Series, Krueger ULTRA-FLO
- B. All registers shall have adjustable blade dampers on all registers.
- C. Furnish and install opposed blade damper on all registers.
- D. Finish to be approved by Architect.

2.06 ACCEPTABLE MANUFACTURERS - DOOR RETURN GRILLES

- A. Titus Model CT-700, Krueger Series 5600, Nailor Industries
- B. Substitutions: Under provisions of Instructions To Bidders.
- C. All aluminum construction & design.
- D. Finish to be approved by Architect.

PART 3.00 EXECUTION

3.01 INSTALLATION

- A. Install items in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Refer to Section 09900.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and register, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Furnish and install necessary frames, bucks, sponge rubber gasketed, etc. to make a neat setting job.
- F. Diffusers shall be placed to insure that air does not blast against columns and lights.
- G. All diffusers, registers, etc. shall have external volume controls and deflecting grids.
- H. Ceilings in areas where plaster or gypsum board ceiling are used, shall be surface mounted.

END OF SECTION

DIVISION 15 - MECHANICAL
SECTION 15954 - TESTING, ADJUSTING, AND BALANCING

PART 1.00 GENERAL

1.01 RELATED DOCUMENTS

- A. All division 15 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

1.02 SCOPE OF WORK

- A. The Contractor shall obtain the services of an independent Test and Balance (TAB) Company which specializes in the testing and balancing of heating, ventilating and air conditioning (HVAC) systems to test, adjust and balance all HVAC systems in the building(s).
- B. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. The testing, adjusting and balancing agency shall act as a reporting agency; that is, list and report each piece of equipment as to identification number, manufacturer, model number, serial number, proper location, specified performance, and report actual performance of all equipment as found during testing. The report is intended to be used during the life of the building as a ready reference indicating original conditions, equipment components, etc.
- C. Representatives of the Test and Balance Company shall visit the job site during installation of the HVAC equipment, piping and ductwork as required.
- D. Upon completion of the HVAC system installation, the Test and Balance Company shall perform all required testing and balancing with the full cooperation of the Contractor and his Sub-contractors. The Contractor shall make changes and/or adjustments to the HVAC system components that are required by the Test and Balance Company to accomplish proper balancing. The TAB agency shall not supply or install any materials or balancing devices such as pulleys, drives, belts, etc. All of this work is by the Contractor and shall be performed at no additional cost to the Owner.
- E. The test and balance report complete with a summary page listing all deficiencies shall be submitted to the Architect for review by his Mechanical Engineer. If the Mechanical Engineer agrees with the report, he shall sign it and return it to the Architect. The test and balance report must be complete and must be accepted by the Mechanical Engineer prior to acceptance of the project. Any outstanding test and balance items shall be placed on the punch list and a monetary value shall be assigned to them.
- F. After all deficiencies have been corrected the Mechanical Engineer shall sign the testing and balancing report, and the Test and Balance Company shall supply four (4) copies of the final and complete report to the Architect for inclusion in the Operation and Maintenance Manuals.
- G. The items requiring testing, adjusting, and balancing include (but are not restricted to) the following:

AIR SYSTEMS

Supply Fans

Zone, Branch, & Main Ducts

Diffusers, registers, & grilles

Coils

1.03 DEFINITIONS, REFERENCES, STANDARDS

- A. All work shall be in accordance with the latest edition of the Associated Air Balance Council (AABC) National Standards or the latest standards of the National Environmental Balancing Bureau (NEBB). If these contract documents set forth more stringent requirements than the AABC National Standards or the NEBB Standards, these contract documents shall prevail.

1.04 QUALIFICATIONS

- A. Agency Qualifications: The TAB Agency shall be a current member of the AABC or the NEBB and must be in good standing with FP&C. A list of these firms shall be obtained from FP&C. Falsification of a TAB report shall be grounds for removal from the FP&C list and the firm's actions shall be reported to the appropriate certification agency. The contractor may use any FP&C approved TAB firm on a state project.

1.05 SUBMITTALS

- A. Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.
- B. Sample Forms: The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards or the NEBB Standards.

1.06 TAB PREPARATION AND COORDINATION

- A. Shop drawings, submittal data, up-to-date revisions, change orders, fan curves, pump curves and other data required for planning, preparation, and execution of the TAB work shall be provided when available and no later than 30 days after the Designer has returned the final approved submittal data to the Contractor.
- B. System installation and equipment startup shall be complete prior to the TAB agency's being notified to begin.
- C. The building control system (BCS) contractor shall provide and install the control system, including all temperature, pressure and humidity sensors. These shall be calibrated for accurate control. If applicable, the BCS contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- D. All test points, balancing devices, identification tags, etc., shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- E. Qualified installation or startup personnel shall be readily available for the operation and adjustment

of the systems. Assistance shall be provided as required for coordination and problem resolution.

1.07 REPORTS

- A. Final TAB Report - The TAB agency shall submit the final TAB report for review by the Architect. On plans provided, all outlets, devices, HVAC equipment, etc., shall be identified (including manufacturer, model number, serial number, motor manufacturer, HP, drive type, fan and motor sheaves and belt number), along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" (or similar NEBB Guaranty) assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards (or similar NEBB Standards). The Designer shall certify his approval on the Performance Guaranty.
- B. Submit 4 copies of the Final TAB Report to the Architect for inclusion in the Operation and Maintenance Manuals.

PART 2.00 INSTRUMENTATION

- A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards (or similar NEBB Standards).

PART 3.00 EXECUTION

3.01 GENERAL

- A. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards (or similar NEBB Standards). Adjustment tolerances shall be + or - 10% unless otherwise stated.
- B. Equipment settings, including manual damper quadrant positions, valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
- C. All information necessary to complete a proper TAB project and report shall be per AABC or NEBB standards unless otherwise noted. The descriptions of work required, as listed in this section, are a guide to the minimum information needed.
- D. TAB contractor shall cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. Upon completion, patch insulation, ductwork and housings using materials identical to those removed. Seal insulation to reestablish integrity of the vapor barrier.
- E. TAB work shall include additional inspection and adjustment of components during the season following the initial balance to include re-balance of any items influenced by seasonal changes or as directed by the Owner.

3.02 AIR SYSTEMS

- A. The TAB agency shall verify that all ductwork, splitters, extractors, dampers, grilles, registers, and diffusers have been installed per design, are functional and set full open. Any leakage in the ductwork shall be repaired prior to the test. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards or NEBB Standards:

For supply fans:

1. Fan speeds - Test and adjust fan RPM to achieve design CFM requirements.
2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.
4. Outside Air - Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees Fahrenheit or use the difference between Pitot-tube traverses of the supply and return air ducts.
5. Static Pressure - Test and record system static pressure, including the static pressure profile of each supply fan.

For exhaust fans:

1. Fan speeds - test and adjust fan RPM to achieve design CFM requirements.
2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.
4. Static Pressure - Test and record system static pressure, including the static pressure profile of each exhaust fan.

For zone, branch and main ducts:

1. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

For diffusers, registers and grilles:

1. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts. Include required CFM, initial test CFM and final CFM.
2. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

For coils:

1. Air Temperature - Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

3.03 ADDITIONAL TAB SERVICES

- A. Job Site Inspections: During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems as required.
- B. Verification of HVAC Controls: The TAB agency shall be assisted by the building control systems Contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:
 - 1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.
 - 2. Verify that all controlling instruments are calibrated and set for design operating conditions.
- C. Temperature Testing: To verify system control and operation, a series of three temperature tests shall be taken at approximately two hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.
- D. TAB Report Verification: At the time of final inspection, the TAB agency may be required to recheck, in the presence of the owner's representative, specific and random selections of data, air quantities, and air motion recorded in the certified report. Points and areas for recheck shall be selected by the owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed 10% of the total number tabulated in the report.

END OF SECTION