

R.G. KREUSLER PARK RESTROOM BUILDING  
AND ENTRY DRIVE MODIFICATIONS - #14204  
Specifications

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GENERAL PROVISIONS

PART 1: GENERAL

1.1 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.2 SCOPE

- A. The Work shall include the furnishings of systems, equipment and materials specified in this Division and as called for on Mechanical Drawings, to include: supervision, operation, methods and labor for the fabrication, installation, start-up and tests for the complete mechanical installation.
- B. Drawings for the Work are diagrammatic, intended to convey the scope of the Work and to indicate the general arrangement and locations of the Work. Because of the scale of the Drawings, certain basic items such as pipe fittings, access panels, hangers, supports, and sleeves may not be shown. This Section shall be responsible for selecting the equipment to fit the space provided. The location and sizes for pipe fittings, sleeves, inserts, fire and/or smoke dampers, and other basic items required by code and other sections shall be coordinated with other trades and specification sections and included for the proper installation of the Work.
- C. Equipment Specification may not deal individually with minute items required such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically called for in the Contract Documents.
- D. Where the words "provide", "furnish", "include" or "install" are used in the Specification or on the Drawings, it shall mean to furnish, install and test complete and ready for operation, the items mentioned. If an item is either called for in the Specification or called for on the Drawings, it shall be considered sufficient for including same in the Work.
- E. Where noted on the Drawings or where called for in other Sections of the Specification, the Contractor for this Division shall install equipment furnished by others, and shall make required service connections. Contractor shall verify with the supplier of the equipment the requirements for the installation.
- F. Coordinate with all trades in submittal of shop drawings. Shop drawings shall be prepared at scale of the larger of 1/4" 1'-0" or that used in the documents, clearly indicating all applicable components. Space conditions shall be detailed to the satisfaction of all concerned trades, subject to review and final acceptance by the Architect. In the event that Contractor installs his work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional

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cost to the Owner. Coordinate drawing requirements with Division One specifications for coordinated shop drawing submittals.

Where shop drawings include items of equipment, the equipment submittals shall be included with the shop drawings. Do not submit equipment and shop drawings as separate submittals.

- G. Should conflicts occur between the mechanical and plumbing drawing and Division 15 of the specifications, the more stringent requirement as determined in the sole opinion of the Engineer, shall take precedent. Where items are shown or specified on either the drawing or in the specifications, they shall be deemed as specified by both and included as part of the contract. Should conflicts occur between Division 15 and other specification divisions, the more stringent requirement as determined in the sole opinion of the Engineer shall prevail.
- H. No interior work shall be installed until the building roof is in place and watertight and the building completed to a stage that in the sole opinion of the engineer, is acceptable and not detrimental to the work to be installed.
- I. Coordinate location of all Division 15 work with Division 16. Do not run piping, ductwork and similar Division 15 work in NEC dedicated service areas for electrical equipment, including above panel boards, starters, communication panels, control panels, telephone backboards, data panels and similar electrical elements. Coordinate with submission of shop drawings and refer questionable locations to architect/engineer for resolution prior to installation and correct non-conforming installed work at no additional cost to the owner.
- J. Where fire, smoke and fire smoke walls and floor slabs are penetrated, such penetrations shall be made perpendicular to the wall or floor slab. Where piping, ductwork, conduit or equipment runs parallel to any wall (both rated and non-rated), a minimum 6 inch clearance shall be provided between the wall and equipment, piping, ductwork or conduit inclusive of insulation.

### 1.3 CODES AND STANDARDS

- A. All work shall be performed in compliance with all applicable Laws, Codes and Regulations of the Governmental Bodies having jurisdiction over the site.
- B. Work not regulated by Governmental Bodies shall be performed in accordance with current and/or adopted issues of the following Codes and Standards.
  - 1. Codes
    - a. Florida Building Code 2010 Edition
    - b. Florida Mechanical Code 2010 Edition
    - c. NFPA-13 (2002), Standard for the Installation of Sprinkler Systems
    - d. NFPA-90A (2012), Standard for the Installation of Air Conditioning and Ventilating Systems
    - e. NFPA-90B (2012), Standard for the Installation of Warm Air Heating and Air Conditioning Systems
    - f. ASHRAE Standard 62.1-2007
    - g. Occupational Safety Act of 1970, as amended (OSHA)

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- h. 59.A-3.079
- i. Other codes as individually referred to in other sections

2. Standards

- a. Air Moving and Conditioning Association - AMCA
- b. American National Standards Institute - ANSI
- c. American Society of Mechanical Engineers - ASME
- d. American Society for Testing and Materials - ASTM
- e. American Water Works Association - AWWA
- f. Factory Mutual - FM
- g. Manufacturers Standardization Society of the Valve and Fittings Industry - MSS
- h. National Electrical Manufacturers Association - NEMA
- i. National Fire Protection Association, National Electrical - NEC
- j. National Fire Protection Association - NFPA
- k. Sheet Metal and Air Conditioning Contractors National Association - SMACNA
- l. Underwriters' Laboratories - UL
- m. American National Standards Institute ANSI/AIHA Z9.5 Laboratory Ventilation
- n. Other Standards as individually referred to in other Sections of the Specification.

- C. Where Code requirements vary from specified requirements alert Engineer prior to proceeding with the work. Where Code requirements exceed or are more strict than specified requirements, the Code requirements shall be included in the Contractor's bid and be incorporated into the work.
- D. Where later editions of the above referenced Codes have been adopted, they shall take precedence.

1.4 FEES, PERMITS AND INSPECTIONS

- A. Coordinate and provide such inspections as are required by the Authorities with jurisdiction over the site. Obtain all necessary permits and pay all fees associated with the work to be performed.

1.5 ACTIVE SERVICES

- A. Existing active services: water (domestic), sewer, electric, fire protection, etc., when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to Owner for determination of procedures and for approval of outages. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the Utility or Municipality having jurisdiction.

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- B. Any active service requiring an outage shall only be as approved by the Owner in writing. Such outages shall be scheduled with the Owner and shall be scheduled to occur during periods which will result in the least disruption to the Owner's operation.

1.6 SITE INSPECTION

- A. Contractor shall inspect and carefully examine the plans and the site to familiarize himself with conditions which will affect his work. He shall verify points of connection with utilities, routing of outside piping to include required clearances from any structures, trees or other obstacles. He shall verify available space in the existing structure and accessibility required for the installation of work under this contract and alert the Architect/Engineer to conditions which may be detrimental or will prevent proper execution of the work.
- B. The submission of a bid will be construed that such an inspection has been performed and extra payment will not be allowed for changes in the Work required resulting from observable existing conditions.

1.7 OPENINGS, CUTTING AND PATCHING

- A. Coordinate the placing of openings in the new structure as required for the installation of the Mechanical Work.
- B. When additional patching is required due to failure to inspect work, then provide the patching required to properly close the openings, to include patch painting.
- C. When cutting and patching of the structure is made necessary due to failure to install piping, ducts, sleeves or equipment on schedule, or due to failure to furnish, on schedule, the information required for the leaving of openings, then provide the cutting and patching as required.
- D. Provide cutting and patching and patch painting in the existing structure, as required for the installation of work, and furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect. Extent of cutting shall be minimized, use core drills, power saws or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

1.8 WIRING FOR MECHANICAL SUPPORT

- A. Division 16 shall provide power services for motors and equipment furnished under this division, to include safety disconnect switches and final connections.
- B. Division 15 shall provide internal wiring, alarm wiring, control wiring or interlock wiring (except the fire alarm system) for equipment furnished, to include temperature control wiring.

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- C. Division 16 shall furnish motor starters for motors furnished by this Contractor, except where other Sections call for starters to be furnished by this Contractor, or where starters or drives are provided integral to the equipment.
- D. Coordinate with Division 16 all motors and other mechanical equipment which require electrical services. Confirm the exact locations for rough-ins, electrical loads, voltage, size and electrical characteristics for all services required, with the Division 16 contractor, prior to submission of shop drawings and equipment cut sheets. Identify any conflicts and bring them to the Architects/Engineers attention prior to ordering equipment.
- E. Where motors or equipment furnished require large services or services of different electrical characteristics than those called for on the Drawings, and/or equipment submittals that were not coordinated between the trades, this contractor shall provide material as required to suit the substitute equipment, at no additional cost to the Owner.

1.9 PROTECTION

- A. Special care shall be taken for the protection of equipment furnished. Equipment and material shall be completely protected from weather elements, painting, plaster, etc., until the project is completed. Damage from rust, paint, scratches, etc., shall be repaired as required to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, or in the ceiling space of the tenant below, the area shall be protected and not marred, soiled or otherwise damaged during the course of such work. Contractor shall arrange with other Contractors for repairing and refinishing of such areas which may be damaged. Access to spaces below the area of work, as needed to install waste piping, shall be coordinated with the building owner's requirements, through the General Contractor. Generally, the contractor's access will be limited to periods when the space is unoccupied by the Tenant.
- C. During construction, the open ends of piping, equipment and ductwork shall be protected from construction dust and debris utilizing caps, plastic sheeting or other approved means. Equipment and materials shall remain in original shipping containers and be kept above grade/slab, until installed.
- D. Building HVAC systems shall not be operated for any purpose during dust generating construction activities. Where conditioning of spaces is necessary during construction, provide temporary HVAC systems to maintain space conditions. If the Contractor operates the newly installed HVAC systems and any damage occurs due to construction, they shall be replaced at no cost to the Owner.

1.10 SUBMITTALS

- A. Method or procedure for submitting shop drawings and submittal data shall be in compliance with the General Conditions, and Division 1 requirements.
- B. Submittal data for mechanical equipment shall consist of shop drawings and/or catalog cuts showing technical data necessary to evaluate the material or equipment,

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to include dimensions, wiring diagrams, performance curves, ratings, control sequence and other descriptive data necessary to describe fully the item proposed and its operating characteristics.

- C. Submittal data shall be clearly marked to indicate the actual item being submitted including accessories, and items not applicable to the submittal shall be crossed or marked out. Where materials or features deviate from the specified requirements, the deviation shall be clearly identified and noted in writing on the submittal cover sheet.

Where manufacturer's standard catalog cut sheets do not provide sufficient detail to indicate full compliance with the project specifications, provide supporting data as required. Where generic unmarked submittals are provided, they will be returned unreviewed for correction and resubmittal by the Contractor.

- D. Submittals shall clearly indicate the specification section and paragraph that applies to the item being submitted.

- E. Submittals shall include, but not be limited to:

- a) Plumbing fixtures and equipment
- b) Vibration isolation
- c) Grilles and diffusers
- d) Ductwork shop drawings, including coordination layout drawing and materials
- e) Exhaust Fans
- f) Pipe and pipe fitting materials
- g) Supports
- h) Evaporators and condensing units
- i) Refrigerant piping
- j) Duct and refrigerant piping insulation
- k) Dampers (automatic and manual)
- l) Ductwork accessories
- m) Ductwork

- F. Basis of Design

- a) Certain manufacturer's products have been designated on the drawings as the basis of design. Other manufacturer's names have been listed as firms producing products that are generally comparable with those used as the basis of design.

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- b) It shall be the exclusive responsibility of the Contractor to ascertain that equipment submitted and used in the work, satisfies all of the specified requirements, including equipment used as the basis of design.
- c) Listing of a product as the basis of design does not imply that the manufacturer's standard product meets the specified requirements. Custom, non-standard modifications in materials of construction, fabrication and components shall be provided, where required to comply with the Contract Documents.

1.11 FINISHING

A. General

- a) Prior to acceptance of the installation and final payment of the Contract, the Contractor shall perform the work outlined herein.

B. Cleaning

- a) At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All tunnels and closed off spaces shall be cleaned of all packing boxes, wood frame members and other waste materials used in the mechanical construction.
- b) All temporary labels, stickers, etc., shall be removed from all fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.).
- c) Air conditioning, plumbing and fire protection equipment, tanks, pumps, traps, etc., shall be thoroughly cleaned and new filters or filter media installed.
- d) Perform cleaning required by General Conditions, and Division 1 as applicable to this Division of the work.

C. Project Recording Documents

- a) Prepare and submit project record documents, in accordance with Division 1 requirements.

D. Operation and Service Manuals

- a) The Contractor shall provide the Owner with a minimum of five (5) copies of a hardbound operating manual for all equipment furnished and installed under his work.
- b) The manual shall include a manufacturer's maintenance and operating instructions and parts list and serial numbers for all operating equipment.
- c) All controls and safety devices shall be clearly and permanently embossed or printed plates as to purposed and as to operation. Plates shall be laminated



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plastic black background with white letters, attached to the equipment or device with screws, rivets or non-soluble cement (glue).

- d) Upon completion of the work, the Contractor shall put the system into service. The Contractor shall be entirely responsible for the equipment during all testing operations.
- e) The contractor shall assist the Test and Balance firm in operation of equipment and providing access (in the form of ladders and scaffolding where required) to devices which require measurement and/or adjustment. The Contractor shall aid in the identification and location of dampers and equipment located above ceilings. The Contractor shall correct all field conditions found to be unsatisfactory by the Test and Balance firm to include but not by way of limitation, reconfiguration of ductwork and fittings, addition/removal of volume dampers, providing duct access doors to evaluate installed conditions, replacement of belts and pulleys and similar tasks as may be necessary but not otherwise required under specific specification sections or other portions of by the contract documents.

1.12 TEST AND DEMONSTRATIONS

- A. Systems shall be tested and placed in proper working order prior to demonstrating systems to Owner.
- B. Prior to acceptance of the mechanical installation, demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct the Owner in the proper operation and maintenance of such systems. The Contractor shall allow for three (3) working days to perform the demonstrations.
- C. Provide necessary trained personnel to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required to assist with the demonstrations.
- D. Dates and times for performing the demonstrations shall be coordinated with the Architect/Owner. A minimum of two training sessions shall be provided, to coordinate with the Owner's staffing/shift requirements. After turnover and two weeks of operation, a follow-up training session shall be provided to answer operational questions from the Owner's staff.
- E. System demonstrations shall be in accordance with operating and maintenance data.
- F. Upon completion of demonstrations, provide a certificate testifying that demonstrations have been completed. Certificate shall list each system demonstrated, dates demonstrations were performed, names of parties in attendance, and shall bear signatures of Contractor and Owner.

1.13 PAINTING AND IDENTIFICATION

- A. Provide painting as scheduled below:
  - a) Touch-up paint where damaged on equipment furnished with factory applied finished, to match original finish.

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b) Exposed fire protection piping shall be painted with two (2) coats of red paint in equipment rooms and service areas. Where piping is exposed to building occupants, it shall be painted to blend in with surrounding surfaces, color as directed by the Architect.

B. Identification of mechanical systems shall be as specified in Section 15085, "IDENTIFICATION".

1.14 CONCRETE WORK

A. Provide concrete bases and housekeeping pads for mechanical equipment unless indicated otherwise. Concrete work shall be as specified in Division 3. Vibration pads and equipment base shall be provided under this Division.

B. Provide equipment anchor bolts and coordinate their proper installation and accurate location.

1.15 ACCESS PANELS

A. Provide access panels where shown, and where required but not shown on the drawings for installation by the drywall Contractor. Access panels shall be as specified in Division 8. All access panel locations shall be approved by the Architect. If not otherwise specified, provide minimum 16 gauge steel panels, continuous concealed hinge, screwdriver operated catch, with prime finish coat, equal to ELMDOR. Doors shall be fire rated where installed in listed fire rated construction assemblies. Panels for "wet" locations such as showers shall be constructed of stainless steel.

1.16 SLEEVES

A. Sleeves passing through non-load bearing or non-fire rated walls and partitions shall be galvanized sheet steel with lock seam joints of minimum gauges as follows: for pipes 2½" size and smaller - 24 gauge; 3" to 6" - 22 gauge; over 6" - 20 gauge.

B. Sleeves passing through load bearing walls, concrete beams, foundations, footings and waterproof floors shall be Schedule 40 galvanized steel pipe or cast iron pipe.

C. Sleeve for fire-rated walls shall comply with the manufacturer's UL listed installation requirements. Where the UL installation requirements allow for sleeve materials which meet the requirements specified in the proceeding paragraphs, sleeves as specified above shall be used.

D. Sleeves for insulated piping shall be of sufficient internal diameter to take pipe and insulation and to allow for free movement of pipe. Waterproof sleeves shall be of sufficient internal diameter to take pipe and waterproofing material. Sleeves passing through underground walls and floors shall be of the modular type, with interlocking mechanical rubber links shaped to fill the annular area between the pipe and wall sleeve, equal and similar to link-seal.

E. In finished areas where pipes are exposed, sleeves shall be terminated flush with wall, partitions and ceilings, and shall extend 1/2" above finished floors. Extend sleeves 1" above finished floors in areas likely to entrap water.

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- F. Sleeves passing through membrane waterproofing or lead safing shall be flashed by Division 7 as required.
- G. Piping and sleeves passing through floors, roof, smoke walls, fire walls, and other partitions, shall be provided with a UL rated firestop assembly. Penetrations of smoke walls shall be fully caulked airtight using an approved sealant.
- H. Ducts shall be provided with 26 gauge sheet metal sleeves where non-rated block or concrete walls are penetrated. The sleeve shall be sized to be between 1 to 2 inches larger than the duct plus insulation (if any) all around and the space between the sleeve and the duct filled with non-combustible insulation (mineral wool or fiberglass). The wall shall be neatly finished to the sleeve with 1 inch by 1 inch by 24 gauge angle attached to the sleeve all around on both sides of the wall.

1.17 ESCUTCHEONS

- A. Provide chrome-plated non-ferrous, corrosion resistant escutcheons at each sleeve opening into finished spaces. Escutcheons shall fit around insulation or around pipe when not insulated; outside diameter shall cover sleeve. Where sleeve extends above finished floor, escutcheon shall be high cap type and shall clear sleeve extension. Secure escutcheons or plates to sleeve but not to insulation with set screws or other approved devices.

1.18 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Ductwork and piping shall not be installed directly above electrical equipment or with NEC required clearance areas. When piping is required to be installed in electrical rooms, a drain pan shall be provided to protect the electrical equipment.

1.19 WARRANTY CALLS

- A. During the one year period, all responses to warranty calls made by the contractor shall be documented by leaving a copy of the mechanics service ticket with the Owner's representative, prior to leaving the site upon completion of his work.
- B. Unless otherwise noted in individual sections, a 1 year warranty shall be provided.
- C. Submit warranty information under provisions of Division 1. Provide information to include terms and conditions, beginning date, duration, name, address, telephone number and procedure for obtaining warranty service.

1.20 INSULATION PROTECTION

- A. Where exposed insulated piping extends to floor, provide sheet metal guard around insulation, up to 12 inches above finished floor.

1.21 PROJECT RECORD DOCUMENTS

- A. Requirements and methods of preparing and procedure for submitting project records shall be in accordance with Division One.

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1.22 OPERATION AND MAINTENANCE MANUALS

- A. Requirements and methods of preparing and procedures for submitting Operating and Maintenance Manuals shall be in accordance with Division One.
- B. Include description of function, operating characteristics, performance curves, engineering data and tests, model and serial numbers of all equipment.
- C. Maintenance information including procedures for routine preventative maintenance, troubleshooting, disassembly, repair, reassembly, aligning and adjusting instructions. Also include lubrication charts and schedules.
- D. Standard manufacturer's data shall be clearly marked to identify model number and features of equipment actually furnished.
- E. All mechanical equipment data shall be provided in a loose-leaf, 3 hole punched binder(s), which includes at a minimum, an identifying cover and spline, section dividers and table of contents. Where required, provide multiple binders such that the thickness of any one binder does not exceed two (2) inches.
- F. At the beginning of each section, provide a summary of the manufacturers recommended preventative maintenance requirements, and the frequency that they are to be performed (monthly, quarterly, yearly, etc.).

1.23 ANCHORING OF EQUIPMENT

- A. All equipment that is not mounted on wheels and is capable of being moved shall be secured to the floor with anchor bolts. A minimum of two bolts are required per each piece of equipment and bolts shall be of sufficient size to prevent equipment of overturning.

1.24 OWNER FURNISHED EQUIPMENT

- A. The Contractor shall coordinate with rough-in dimensions, services required (gas, water, exhaust), maintenance access areas and the exact location of Owner furnished equipment.

1.25 PREVENTION OF CORROSION

- A. The Contractor shall use materials of construction that will aid in the prevention of corrosion.
- B. Dissimilar metals shall be separated by dielectric fittings and/or materials.
- C. Copper pipe shall be isolated from concrete.
- D. Exterior supports and fasteners shall be constructed of galvanized or stainless steel.

END OF SECTION

SECTION 15085

IDENTIFICATION

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide equipment, materials, tools, labor and supervision necessary to label and identify piping systems equipment, valves, and duct systems as specified herein.

1.03 QUALIFICATIONS

- A. Piping identification materials by Allen Systems, Brady, Seton, or Industrial Safety Supply Company.

1.04 SUBMITTALS

- A. Submit manufacturer's catalog cuts including installation instruction showing complete descriptive data.
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification of piping, equipment and duct systems.
- C. Submit valve chart and schedule, including valve tag number, location function, manufacturer's name and model number.

PART 2: PRODUCTS

2.01 MATERIALS

- A. All non-insulated piping shall be identified with snap-on type identification markers.
- B. For insulated piping systems provide snap-on type identification markers.
- C. For pipes under 3/4" O.D. (too small for color bands and legends), provide stamped metal tags at locations of pipe markers, attached to pipe with 16-gauge copper or stainless steel wire.
- D. For buried piping, use metallic backed 6 inch wide by 4 mil thick tape above pipe.
- E. For exterior piping, use weather-resistant, non-vinyl chloride markers constructed of polyester materials, pressure sensitive type.

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2.02 LABEL AND COLOR

- A. Labeling and color coding shall be in accordance with "Scheme for the Identification of Piping Systems" (ANSI A13.1-1975), and as specified herein.
- B. Each marker must show (1) approved color-coded back- ground, (2) proper color of legend in relation to background color, (3) approved legend letter size, (4) approved marker length, (5) directional flow arrow, and (6) fluid being conveyed.
- C. Provide legend indicating color and service in the operating and maintenance manuals.

2.03 LOCATION OF PIPE MARKERS

- A. Locations for pipe markers in equipment rooms shall be as follows:
  - a) Adjacent to each valve and fitting (except on plumbing fixtures and equipment).
  - b) At each branch and riser take-off.
  - c) At each pipe passage through wall, floor and ceiling connection.
  - d) On all horizontal pipe runs-marked every 25 feet, except that medical gases shall be labeled every 20 feet.
- B. Locations for pipe markers above ceilings in finished areas.
  - a) Adjacent to each valve.
  - b) On all horizontal pipe runs-marked every 20 feet, and at least once in each separate space through which the piping passes.

2.04 VALVES

- A. Identify each valve with stamped metal tag.
- B. Provide schedule listing valve number and their location. Schedule shall be provided in the operating and maintenance manuals.
- C. All main and branch line valves are to be tagged in accordance with the following numerical schedule, except where an existing scheme is already in-place, it shall be followed:

Cold Water	1000 - 1999
Hot Water Circulated	2900 - 2999

2.05 DUCTWORK

- A. Identify exhaust air ductwork using stenciled lettering, minimum 3 inch tall with exhaust fan number.

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2.06 PIPE COLOR CODE

- A. Piping and jacketing where insulated in mechanical rooms, equipment rooms, fan rooms, boiler rooms shall be painted.
- B. Surfaces to receive paint shall be prepared in accordance with Division 9. Where not otherwise specified, follow the manufacturer's recommendations.
- C. Provide not less than two color coats of paint, minimum dry-film thickness of 2 mils. Primer coat shall be as recommended by the paint manufacturer.
- D. Provide the following colors (color based upon Sherwin Williams):
  - 1) Hot Water Heating: Power Orange SW4074
  - 2) Domestic Cold Water: Turbine Blue SW4064
  - 3) Domestic Hot Water: Recycled Red SW4073
  - 4) Fire Protection: Safety Red SW4081

PART 3: EXECUTION

3.01 PREPARATION

- A. De-grease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09900 for stencil painting.

3.02 INSTALLATION

- A. Plastic Nameplates: Install with corrosive-resistant mechanical fasteners.
- B. Metal Tags: Install with corrosive-resistant brass bead or jack chain.
- C. Stencil Painting: Apply paint in general accordance with Division 9.
- D. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.
- E. Equipment: Identify air handling units, and related equipment with plastic nameplates.
- F. Valves: Identify valves in main and branch piping with tags.
- G. Piping: Identify piping, concealed or exposed, with plastic pipe markers. Tags may be used on small diameter piping. Identify service, flow direction and pressure. Install in clear view and align with axis of piping.
- H. Ductwork: Identify ductwork with stenciled painting. Identify as to air handling unit number. Locate identification at air handling unit, at each side of wall penetrations, structure or enclosure, and at each obstruction. Label fire and smoke dampers and access doors.

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3.03 VALVE CHART AND SCHEDULE

- A. Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location in each equipment room as directed.

3.04 MARKER COLOR CODING

<u>Symbol</u>	<u>Contents</u>		<u>Pipe Color</u>	<u>Marker Color</u>
DWC	Domestic Cold Water		Light Green	Green
DWH	Domestic Hot Water		Dark Green	Green
FP	Fire Protection		Red	Red
SAN	Sanitary Drain	—		White
VENT	Vent		—	White

Where colors different than the above are already being used for existing services, follow existing identification scheme, and note same in product submittals, prior to purchase and installation of identification products.

3.05 LOCATION

- A. At valve locations above accessible type suspended ceilings, provide a green color adhesive 1" diameter dot on the closest ceiling grid beneath the valve.

END OF SECTION



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SECTION 15141  
HANGERS and SUPPORTS for PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. Pipe and equipment hangers and supports
- B. Sleeves and seals
- C. Flashing and sealing equipment and pipe stacks

1.2 REFERENCES

- A. ASME B31.1 - Power Piping
- B. ASME B31.9 - Building Services Piping
- C. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- D. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacture
- E. MSS SP69 - Pipe Hangers and Supports - Selection and Application
- F. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices
- G. NFPA 14 - Installation of Standpipe and Hose Systems

1.3 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer Installation Instructions: Indicate special procedures and assembly of components.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of plumbing and hydronic piping.
- B. Supports for Sprinkler Piping: In conformance with NFPA 13.
- C. Supports for Standpipes: In conformance with NFPA 14.

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PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - DWV:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89
2. Hangers for pipe sizes 2 to 1½", use carbon steel adjustable swivel split ring.
3. Hangers for pipe sizes 2" and over, use carbon steel adjustable clevis.
4. Multiple or trapeze hangers, use steel channels with welded spacers and hanger rods.
5. Wall support for pipe sizes to 3", use cast iron hook.
6. Wall support for pipe sizes 4" and over, use welded steel bracket and wrought steel clamp.
7. Vertical support use steel riser clamp.
8. Floor support, use cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper pipe support, use vinyl coated carbon steel ring, adjustable.
  - a. Do not use copper plated or copper clad hangers.

B. Plumbing Piping - Water:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89.
2. Hangers for pipe sizes 2 to 1½" use carbon steel adjustable swivel split ring.
3. Hangers for cold pipe sizes 2" and over, use Carbon steel adjustable clevis.
4. Hangers for hot pipe sizes 2 to 4", use carbon steel adjustable clevis.
5. Hangers for hot pipe sizes 6" and over, use adjustable steel yoke cast iron roll double hanger.
6. Multiple or trapeze hangers, use steel channels with welded spacers and hanger rods.
7. Multiple or trapeze hangers for hot pipe sizes 6" and over, use steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall support for pipe sizes to 3" use cast iron hook.
9. Wall support for pipe sizes 4" and over, use welded steel bracket and wrought steel clamp.
10. Wall support for pipe sizes 6" and over, use welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical support use steel riser clamp.
12. Floor support for cold pipe any size, use cast iron adjustable pipe saddle, lock nut nipple, floor flange, and concrete pier or steel support.
13. Floor support for hot pipe sizes 4", use cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor supports for hot pipe sizes 6" and over, use adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper pipe support use vinyl coated carbon steel ring, adjustable.
  - a. Do not use copper plated or copper clad hangers.

2.2 ACCESSORIES

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

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### 2.3 INSERTS

- A. Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

### 2.4 FLASHING

- A. Metal flashing: 26-gage galvanized steel.
- B. Metal Counter-flashing: 22-gage galvanized steel.
- C. Lead Flashing:
  - 1. Waterproofing, 5-lb/sq ft sheet lead
  - 2. Soundproofing, 1-lb/sq ft sheet lead
- D. Flexible Flashing, 47-mil thick butyl sheet; compatible with roofing
- E. Caps, steel 22-gage minimum; 16-gage at fire resistant elements

### 2.5 EQUIPMENT CURBS

- A. Fabrication: Welded 18-gage galvanized steel shell and base, mitered 3" cant, variable step to match roof insulation, factory installed wood nailer.

## PART 3 EXECUTION

### 3.1 INSTALLATION

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

### 3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4".
- D. Where concrete slabs form-finished ceiling, locate inserts to be flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below, and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

### 3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal and vertical piping in accordance with FBC Plumbing.

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- B. Install hangers to provide minimum 2" space between finished covering and adjacent work.
- C. Place pipe hanger within 12" of each turn or elbow.
- D. Use hangers with 1½" minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5' maximum spacing between hangers.
- F. Support vertical piping at every floor.
  - 1. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide vinyl coated carbon steel hangers and supports.
  - 1. Do not use copper plated or copper clad hangers.
  - 2. Avoid contact of dissimilar metals.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports.
  - 1. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not exposed.

#### 3.4 FLASHING

- A. Provide flexible flashing and metal counter-flashing where piping and ductwork penetrate weather or waterproofed walls, floors and roofs.
- B. Flash vent and soil pipes projecting 3" minimum above finished roof surface with lead worked one-inch minimum into hub, 8" minimum clear on sides with 24" x 24" sheet size.
  - 1. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead; 10" clear on sides with minimum 36" x 36" sheet size.
  - 1. Fasten flashing to drain clamp device.
- D. Seal floor drains and mop sink drains watertight to adjacent materials.

#### 3.5 SLEEVES

- A. For construction and execution, refer to Division 1.

END OF SECTION

SECTION 15411  
FACILITY POTABLE WATER DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The drawings, schedules, and specifications indicate the extent of potable water systems work.
- B. Refer to the drawings for insulation required in conjunction with potable water piping.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5-years.
- B. Codes and Standards:
  - 1. Plumbing Code Compliance: Comply with applicable portions of the Florida Building Code pertaining to selection and installation of plumbing materials and products.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for potable water systems materials and products.
- B. Show grooved joint couplings and fittings on drawings and product submittals, and specifically identify with the applicable manufacturer's style number.

PART 2 PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. General:
  - 1. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated.
  - 2. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.
  - 3. Provide materials and products complying with plumbing code where applicable.
  - 4. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in potable water systems.
  - 5. Where indicating more than one type of material or product, selection is Installer's option.

2.2 BASIC PIPES AND PIPE FITTINGS

- A. General:
  - 1. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated in section 15420.
  - 2. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.

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3. Provide sizes and types matching piping and equipment connections; provide fittings of materials, which match pipe materials used in potable water systems.
4. Where indicating more than one type of material or product, selection is Installer's option.

### 2.3 BASIC PIPING SPECIALTIES

- A. General: Provide piping specialties complying with Section 15430, in accordance with the following listing:
1. Pipe escutcheons
  2. Low-pressure Y-type pipeline strainers
  3. Dielectric unions
  4. Mechanical sleeve seals
  5. Fire Barrier penetration seals
  6. Water hammer arresters
  7. Pipe sleeves
  8. Sleeve seals

### 2.4 BASIC SUPPORTS AND ANCHORS

- A. General: Provide supports and anchors complying with Section 15141, in accordance with the following listing:
1. Adjustable steel clevises and adjustable pipe saddle supports for horizontal piping hangers and supports.
  2. Two-bolt riser clamps for vertical piping supports.
  3. Concrete inserts, C-clamps, and steel brackets for building attachments.
  4. Protection shields for insulated piping support in hangers.

### 2.5 BASIC VALVES

- A. General: Provide valves complying with Section 15420, in accordance with the following listing:
1. Sectional Valves:
    - a. 2" and Smaller: Ball valves
    - b. 2½" and Larger: Gate valves
  2. Shutoff Valves:
    - a. 2" and Smaller: Ball valves
    - b. 2½" and Larger: Gate valves
  3. Drain Valves:
    - a. 2" and Smaller: Gate valves or ball valves
    - b. 2½" and Larger: Gate valves
  4. Check Valves:
    - a. All Sizes: Swing check valves

### 2.6 RELIEF VALVES

- A. General: Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Combined Pressure Temperature Relief Valves: Provide bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F (99°C), and pressure relief at 150 psi.
- C. Manufacturer: Subject to compliance with requirements, provide relief valves of one of the following:
1. Cash (A.W.) Valve Mfg. Corp
  2. Conbraco Industries, Inc

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3. Watts Regulator Co
4. Zurn Industries, Inc; Wilkins-Regulator Div

### PART 3 EXECUTION

#### 3.1 INSPECTION

- A. General:
  1. Examine installation areas and conditions under which potable water systems.
  2. Do not proceed with work until unsatisfactory conditions are corrected and acceptable to Installer.

#### 3.2 INSTALLATION OF POTABLE WATER DISTRIBUTION PIPING:

- A. General: Install water distribution piping in accordance with Section 15420.
  1. Install piping level and plumb, unless specified otherwise.
- B. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- C. Electrical Equipment Rooms: Do not run piping thru electrical equipment rooms or above electric panels.

#### 3.3 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Section 15430.

#### 3.4 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports, anchors, and seals in accordance with Section 15141.

#### 3.5 INSTALLATION OF VALVES

- A. Install valves in accordance with Section 15420.
- B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.
- C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

#### 3.6 EQUIPMENT CONNECTIONS

- A. Piping Run outs to Fixtures: Provide hot and cold water piping run outs to fixtures of sizes and indicated, but in no case smaller than required by the plumbing code.

#### 3.7 FIELD QUALITY CONTROL

- A. TESTING:
  1. Flush Out the piping systems with clean water before proceeding with required tests.
    - a. Inspect each run of each system for completion of joints, supports, and accessory items.
  2. Hydraulically pressure test each section or segment of the system prior to backfilling, encasing, enclosing or otherwise preventing visual observation of the section or segment being tested.
    - a. Backfill the underground systems, only after passing the required test
    - b. Exposing joints only, permitted on all systems and required on systems having a pressure test exceeding 30 psig.

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3. Water test potable water system at 150% of design pressure, (100 psig minimum) for a period of 4 hours using a gage with a 0 psi to 200 psi and a minimum of 4 2 " dial.
4. Disinfect potable water system: See "Plumbing Piping" for disinfection specification.

3.8 SPARE PARTS

- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF SECTION



SECTION 15412  
FACILITY SANITARY DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The drawings, schedules, and specification indicate the extent of soil and waste systems work.
- B. The exterior sanitary sewer system specifications are in applicable Division-2 sections.
- C. Refer to appropriate Division-2 sections for exterior sanitary sewer system required in conjunction with soil and waste systems; not work of this section.
- D. The installation for soil and waste systems specifications are in applicable Division-15 sections, and included as work of this section.
- E. The trenching and backfilling in conjunction with underground building drain piping specifications are in applicable Division-15 sections, and included as work in this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Firms regularly engaged in manufacturer of soil and waste systems products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5-years.
- B. Codes and Standards:
  - 1. Plumbing Code Compliance: Comply with applicable portions of the FBC pertaining to plumbing materials, construction, and installation of products.
  - 2. ANSI Compliance: Comply with applicable ANSI standards pertaining to materials, products, and installation of soil and waste systems.
  - 3. ASSE Compliance: Comply with applicable ASSE standards pertaining to materials, products, and installation of soil and waste systems.
  - 4. PDI Compliance: Comply with applicable PDI standards pertaining to products and installation of sanitary systems.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for soil and waste systems materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed soil and waste systems, in accordance with requirements of Division 1.

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C. Maintenance Data:

1. Submit maintenance data and parts lists for soil and waste systems materials and products.
2. Include this data, product data, shop drawings, and record drawings in maintenance manual, in accordance with requirements of Division 1.

PART 2 PRODUCTS

2.1 MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated in section 15420.
- B. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.
- C. Provide sizes and types matching piping and equipment connections; provide fittings of materials that match pipe materials used in soil and waste systems.
- D. Where more than one type of material or product is indicated, selection is Installer's option.

2.2 BASIC PIPING SPECIALTIES

- A. General: Provide piping specialties complying with section 15430, in accordance with the following listing:
  1. Pipe Escutcheons
  2. Mechanical Sleeve Seals
  3. Fire Barrier Penetration Seals
  4. Pipe Sleeves
  5. Sleeve Seals

2.3 BASIC SUPPORTS AND ANCHORS

- A. General: Provide supports and anchors complying with sections 15141 in accordance with the following listing:
  1. Adjustable steel clevis hangers, steel pipe clamps, and pipe saddle supports for horizontal piping hangers and supports.
  2. Two-bolt riser clamps for vertical piping supports. Concrete inserts, C-clamps, and steel brackets for building attachments.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine installation of substrates and conditions of soil and waste systems.
- B. Do not proceed with work until any unsatisfactory conditions are corrected and acceptable to Installer.

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3.2 INSTALLATION OF ABOVE GROUND PIPING

- A. Install soil and waste piping in accordance with FBC.
- B. Do not install drain piping over electrical equipment rooms.

3.3 INSTALLATION OF BUILDING DRAIN PIPING

- A. General: Install underground building drains as indicated and in accordance with FBC.
  - 1. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert.
  - 2. Place bell ends of piping facing upstream.
- B. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
  - 1. Clean interior of piping of dirt and other superfluous material as work progresses.
  - 2. Maintain swab or drag in line and pull past each joint as it is completed.
  - 3. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- C. Install soil and vent piping pitched to drain at minimum slope of ¼" per foot (2%) for piping 2" and smaller, and 1/8" per foot (1%) for piping 3" and larger.

3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with sections 15430.

3.5 INSTALLATION OF SUPPORTS AND ANCHORS

- A. Install supports and anchors in accordance with sections 15141.

3.6 INSTALLATION OF DRAINAGE PIPING PRODUCTS

- A. Cleanouts:
  - 1. Install in above ground piping and building drain piping as indicated, as required by FBC.
  - 2. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building and provide a finish, which is flush with the building surface.
- B. Flashing Flanges, install a flashing flange and clamping device on each stack and cleanout passing through a waterproof membrane.
- C. Vent Flashing Sleeves:
  - 1. Plumbing Contractor shall supply the vent flashing sleeves and the Roofing Contractor shall install.
  - 2. See Architectural specifications and details for type of flashing required.

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3.7 INSTALLATION OF TRAP PRIMERS

- A. Install trap primers as indicated, and in accordance with manufacturer's installation instruction.
- B. Pitch piping towards drain trap, a minimum of 1/8" per foot (1%).
- C. Adjust trap primer for proper flow.

3.8 INSTALLATION OF FLOOR DRAINS

- A. General: install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Coordinate flushing work with work of waterproofing and adjoining substrate work.
- C. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems.
- D. Install floor drains at lowest point of surface areas to be drained, or as indicated.
  - 1. Set tops of drains flush with finished floor.
- E. Install drain-flashing collar or flange so that no leakage occurs between drain and adjoining flooring.
  - 1. Maintain integrity of water proof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.

3.9 EQUIPMENT CONNECTIONS

- A. Piping Run outs to Fixtures: Provide soil and waste piping run outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by FBC.
- B. Locate piping run outs as close as possible to bottom of floor slab supporting fixtures or drains.

3.10 FIELD QUALITY CONTROL

A. TESTING

- 1. Flush out piping systems with clean water before proceeding with required tests.
  - a. Inspect each run of each system for completion of joints, support, and accessory items.
- 2. Hydraulically pressure test each section or segment of the system prior to backfilling, encasing, enclosing, or otherwise preventing visual observation, or the section or segment being tested.
  - a. Contractor shall backfill the underground piping systems after passing the testing.
  - b. Exposing joints only, permitted on all systems and required on systems having a pressure test exceeding 30 psig.
- 3. Water test soil, waste and vent system at 10' of head for 4 hours.
  - a. The test stand pipe shall be a minimum of 10' above the highest point or section tested.

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B. PROTECTON

1. Protect drains during remainder of construction period, to avoid clogging with construction materials and debris, and to prevent damage from traffic and construction work.

END OF SECTION

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SECTION 15420  
PLUMBING PIPING

PART 1 GENERAL

1.1 SCOPE

- A. Work consists of all plumbing work indicated on drawings and specified herein.
- B. Included are requirements for fees/permits for installation and inspection of all plumbing work.
- C. Also see "Instructions to Bidders," "General Conditions," "Supplementary General-Conditions," "Special Conditions," and "General Requirements for Mechanical and Electrical Work" which are hereby made part of this section and govern in the event there is a conflict with this section.

1.2 SECTION INCLUDES

- A. Pipe and pipe fittings
- B. Valves
- C. Sanitary sewer piping system
- D. Domestic water piping system

1.3 REFERENCES

- A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 ns 300
- B. ANSI/ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- C. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV
- E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
- F. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications
- G. ANSI/ASTM B32 - Solder Metal
- H. ANSI/ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fitting, Schedule 40
- I. ANSI/AWS D1.1 - Structural Welding Code
- J. ASME - Boiler and Pressure Vessel Code
- K. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless
- L. ASTM A74 - Cast iron Soil Pipe and Fitting
- M. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses
- N. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and elevated Temperatures
- O. ASTM A395 - Ferritic Ductile Iron Pressure Retaining Castings
- P. ASTM A536 Ductile Iron Castings
- Q. ASTM B88 - Seamless Copper Water Tube
- R. ASTM B306 - Copper Drainage Tube (DWV)
- S. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- T. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- U. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings
- V. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
- W. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings
- X. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) Composite-Sewer Piping
- Y. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe

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- Z. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- AA. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Piping and Fittings
- BB. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- CC. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- DD. ASTM D3034 -Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- EE. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- FF. AWS A5.8 - Brazing Filler Metal
- GG. AWWA C601 - Standard Methods for the Examination of Water and Waste Water
- HH. AWWA C606 – Grooved and Shouldered Joints
- II. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems
- JJ. ASTM D635 - Flame Retardant

#### 1.4 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME and applicable state labor regulations.
- C. Provide Welder Certification in accordance with ANSI/ASME Sec. 9.

#### 1.5 SUBMITTALS

- A. Submit product data under provisions of Division 1.
- B. Include data on pipe materials, pipefittings, valves, and accessories.

### PART 2 PRODUCTS

#### 2.1 SANITARY SEWER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. See section 22 05 00 part 2.1 f for additional material requirements.
- B. PVC Pipe: ASTM D2665
  - 1. Fittings: PVC
  - 2. Joints: ASTM D2855, solvent weld

#### 2.2 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2665
  - 1. Fittings: PVC
  - 2. Joints: ASTM D2855, solvent weld (Not allowed in plenums)

#### 2.3 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

- A. Copper Tubing:
  - 1. ASTM B88, Type K, hard drawn
  - 2. Fittings:
    - a. Soldered: ANSI/ASME B16.29, wrought copper
  - 3. Joints:
    - a. Soldered: ANSI/ASTM B32, solder, Grade 95TA

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## 2.4 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn
  - 1. Fittings:
    - a. Soldered: ANSI/ASME B16.18 - bronze sand casting, ANSI/ASME B16.22 - wrought copper, ANSI/ASME B16.23 - cast brass, or ANSI/ASME B16.29 - wrought copper.
  - 2. Joints:
    - a. Soldered: Grooved joints or ANSI/ASTM B32, solder, Grade 95TA

## 2.5 WATER PIPING, BELOW GRADE UNDER SLAB

- A. Copper Tubing:
  - 1. ASTM B88, Continuous Type L soft drawn.
  - 2. Piping under slab shall be continuous with no joints.
  - 3. Provide with polypropylene flexible sleeve.

## 2.6 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2" and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2": 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16" thick preformed neoprene bonded.
- C. Grooved and Shouldered Pipe End Couplings: Ductile iron housing clamps to engage and lock, where required, designed to permit some angular deflection, contraction, and expansion; 'C' shape pressure responsive synthetic rubber sealing gasket conforming to ANSI/NSF-61; steel bolts, nuts and washers; galvanized couplings for galvanized pipe.
  - 1. IPS Steel Piping:
    - a. Rigid Type: Use coupling housings cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9 and NFPA 13.
    - b. Flexible Type, use in locations where vibration attenuation and stress relief are required.
      - i) May use flexible couplings in lieu of flexible connectors at equipment connectors.
      - ii) Place couplings in close proximity to the vibration source.
    - c. Flange Adapters: Flat face, for direct connection to ANSI Class 125 or 150 flanged components.
  - 2. Hard Copper Tube: Housings cast with offsetting angle-pattern bolts pads.
    - a. Housings coated with copper colored alkyd enamel.
    - b. Manufacture to copper tube dimensions with FlushSeal® type gasket.
- D. Dielectric Connections: Union or waterway with galvanized or plated steel threaded end, copper solder end, steel or ductile iron grooved end, and water impervious isolation barrier.

## 2.7 BALL VALVES

- A. Up to 2":
  - 1. Bronze body, stainless steel ball with Teflon seats and stuffing box ring, lever handle.
  - 2. Valves in copper pipe use soldered joint ends or end compatible with piping system.



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B. Over 2":

1. Cast steel body; chrome plated steel ball, Teflon seat and stuffing box seals, lever handle.
2. Ductile iron body; chrome plated carbon steel ball and stem, Teflon seat, lever handle.

2.8 RELIEF VALVES

- A. Bronze body, Teflon seat, steel stem, and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- 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 the piping at a common elevation and location whenever practical.
- 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. Arrange water piping to drain at low points.
- I. Establish elevations of buried piping outside the building to ensure not less than ft of cover.
1. Slope piping and arrange to drain at low points.
- J. When welding pipe support members to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to weld.
- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
- L. Install bell and spigot pipe with bell end upstream.
- M. Install valves with stems upright or horizontal, not inverted.

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N. Install a hose bibb on one lavatory (minimum) per group restroom.

3.3 APPLICATION

- A. Use an approved mechanical couplings and fasteners only in accessible locations or as approved by engineer.
- B. Install unions or grooved joint couplings downstream of valves at equipment or apparatus connections.
- C. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.4 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form, throughout system to obtain 50-to 80-mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15% of outlets.
- E. Maintain disinfectant in system for 24-hours.
- F. If final disinfectant residual tests less than 25-mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water of 1.0-mg/L.
- H. Take samples no sooner than 24-hours after flushing, from 5% of outlets and from water entry, and analyze in accordance with AWWA C601.

END SECTION

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Specifications

SECTION 15430  
PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SCOPE

- A. Work consists of all plumbing work indicated on drawings and specified herein.
- B. Also included are all fees and permits for installation and inspection of all plumbing work.
- C. Direct attention to "Instructions to Bidders", "General Conditions", "Supplementary General Conditions", "Special Conditions", and "General Requirements for Mechanical and Electrical Work" which are hereby made part of this section and shall govern in the event there is a conflict with this section.

1.2 SECTION INCLUDES

- A. Cleanouts
- B. Water hammer arrestors
- C. Hose bibs hydrants
- D. Trap Primers

1.3 REFERENCES

- A. ASSE 1012 - Backflow Preventors with Immediate Atmospheric Vent
- B. ASSE 1011 - Hose Connection Vacuum Breakers
- C. ASSE 1013 - Backflow Preventors, Reduced Pressure Principle
- D. ANSI A112.21.1 - Floor Drains
- E. ANSI A112.21.2 - Roof Drains
- F. ANSI A112.26.1 - Water Hammer Arrestors
- G. PDI WH-201 - Water Hammer Arrestors
- H. FBC- Florida Building Code

1.4 QUALITY ASSURANCE

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

1.5 SUBMITTALS FOR REVIEW

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Include component sizes, rough-in requirements, service sizes, and finishes.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

- A. See schedule on drawings for manufacturer and model.

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## 2.2 CLEANOUTS

- A. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover; based on Model 4240-NB-U manufactured by JR Smith.
- B. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover with 24" x 24" x 4" concrete surround; based on Model 4231 manufactured by JR Smith.
- C. Interior Finished Floor Areas: Galvanized cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze strainer, round with scoriated cover in service areas and square with depressed cover to accept floor finish in finished floor areas; based on Model 4020-4160 manufactured by JR Smith.
- D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round gasketed cover, and round stainless steel access cover secured with machine screw; based on Model 4452-U manufactured by JR Smith.
- E. Interior Unfinished Accessible Areas Threaded types provide bolted stack cleanouts on vertical rainwater leaders.

## 2.3 WATER HAMMER ARRESTORS

- A. ANSI A112.26.1; size in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300°F and maximum 250-psi working pressure.
- B. Acceptable Manufacturers
  - 1. J. R. Smith Series 5000
  - 2. Josam Series 75000
  - 3. Zurn "Shoktrol"
  - 4. Sioux Chief Series 600

## 2.4 WALL HYDRANTS

- A. ANSI/ASSE 1011; vandal-proof cast bronze, mild-climate recessed wall hydrant with satin face, self-opening locking cover removable key, 3/4" HPT outlet, integral vacuum breaker; recessed stainless steel box.
- B. Acceptable Manufacturers
  - 1. J. R. Smith #5509QT-SAP
  - 2. Josam #71010
  - 3. Zurn #Z-1320
  - 4. Woodford #B75

## 2.5 HOSE BIBS

- A. ANSI/ASSE 1011; cast bronze hose bib with laceable hexagonal disc, 3/4" HPT outlet, vacuum breaker.
- B. Acceptable Manufacturers
  - 1. J. R. Smith #5609QT-SAP
  - 2. Josam #71070
  - 3. Zurn #Z1310
  - 4. Woodford #84

## 2.6 TRAP PRIMER

- A. Automatic 1/2" trap primer systems for all interior floor drains.
- B. Acceptable Manufacturers
  - 1. J. R. smith Series 2699
  - 2. Josam #88250
  - 3. Zurn #Z-1022

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- 4. Sioux Chief
- C. Trap primers connected to sink or lavatory wastes not permitted.

## 2.7 VENT CAP

- A. Stainless Steel dome secured with recessed allen-socket head set screw.
- B. Acceptable Manufacturers
  - 1. J. R. Smith #1748
  - 2. Josam #26700
  - 3. Zurn #Z-193

## 2.8 VALVE BOX

- A. Provide an underground valve box with traffic cover.
- B. Acceptable Manufacturer
  - 1. Brooks Products, Inc.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Coordinate cutting and forming of roof and 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. Install a trap primer on each floor drain.
- C. Extend cleanouts to finished floor or wall surface.
  - 1. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
  - 2. Ensure clearance at cleanout for rodding of drainage system.
- D. Encase exterior cleanouts in 24 x 24 x 4 inches concrete flush with grade.
- E. Install cleanouts at the base of each vertical stack.
- F. Install cleanouts at each change of direction of horizontal run.
- G. Install cleanouts at 50-foot intervals of horizontal runs.
- H. Install water hammer arrestors to be accessible complete with accessible isolation valve.
- I. Install ¾" hose bibs/hydrants with vacuum breaker and gate valve on the exterior of all buildings with a maximum spacing of 150 feet.
- J. Install one ¾" hose bib/hydrant with vacuum breaker in each group restroom.

END OF SECTION

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Specifications

SECTION 15440  
PLUMBING FIXTURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this section.

1.2 SCOPE

- A. Provide fixtures, trim, accessories, labor, and supervision necessary for the plumbing fixture installation.

1.3 FIXTURE SCHEDULE

- A. Fixtures, trim and accessories shall be of type and model numbers as scheduled on the drawings.

1.4 SUBMITTALS

- A. Submit catalog cuts giving manufacturer's model numbers, fixtures and rough-in dimensions and construction material for each type of fixture, trim, and accessory scheduled.
- B. Submit to the construction manager cutout trim plates for sinks, installed in counter tops.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. All manufacturers shall be a United States based company doing business in the U.S. for at least 10-years.

2.2 VITREOUS AND CAST IRON FIXTURES

- A. Vitreous ware shall be non-absorbent, even color, unwrapped, two-fired vitreous china, grade "A" as rated by the Bureau of Standards.
- B. Enameled cast iron fixtures shall have the enamel fused with the iron to provide a hard acid-resisting enameled finish.
- C. Vitreous and enamel fixtures shall be white, except where other colors are called for in schedule.
- D. Vitreous China and Cast Iron Enameled Fixtures
  - 1. Vitreous china and cast iron enameled fixtures by American Standard, Zurn, Kohler, or Sloan,
  - 2. Use low flow, 1-pint, urinals for existing building with metal drain systems.

2.3 STAINLESS STEEL SINKS

- A. Provide stainless steel sinks fabricated from 18-gauge nickel-bearing type 302, 28-8 stainless steel, except laboratories where they shall be type 316, with stain finish, and sound deadening treatment.
- B. When a non-self rimming sink is specified, furnish sinks with Hudee mounting rim.

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C. Stainless Steel Sinks

1. Stainless steel sinks by Just, Elkay, or Moen.

2.4 TRIM

- A. Trim for conventional fixtures shall include supply pipes, stop valves, faucets, tailpieces, strainers, wastes, traps, floor and wall escutcheon plates, which shall be brass.
  1. Exposed trim shall be chrome plated.
- B. Stop valves shall be compression type with loose key or screwdriver control.
- C. P-traps shall be adjustable cast brass with cleanout plug.
- D. Faucets shall contain standardized interchangeable operating units for both hand closing and self-closing types, closing with the pressure of the water.
- E. Faucets for lavatories shall be 0.5-gpm maximum flow rate.
- F. Omit supply side trim for waterless urinals.
- G. Trim, brass trim by American Standard, or Chicago Faucet, Moen, or Toto.

2.5 DRINKING FOUNTAINS AND WATER COOLERS

- A. Drinking fountains and water coolers by Halsey Taylor, Elkay, or Haws.

2.6 Floor Drains

- A. Floor drains shall be Josam, J. R. Smith, Wade, or Zurn.

2.7 Flush Valves – Manual

- A. Provide and install flush models as indicated on plumbing plans.
- B. Acceptable manufacturers: Moen, Sloan, Toto, or Zurn.

2.8 Hand washing Faucet - Manual

- A. Provide and install models as indicated on plumbing plans.
- B. Provide vandal resistant spray head with 0.5gpm flow rate.
- C. Acceptable manufacturers: Chicago Faucet, Moen, Sloan, Toto, or Zurn

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fixtures, then make water supply, waste and vent connections.
- B. Set fixtures in center of stalls, between partitions where required, verify dimensions for spacing.

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- C. Setting shall be absolutely tight and rigid on proper ground.
  - 1. Use Miracle Adhesive Corporation Tub-Caulk or approved equal pointing materials under all setting surfaces.
  - 2. Grout water closets.
- D. Cover the fixtures with paper glued in place after they are set to prevent damage during the balance of construction.
  - 1. At the conclusion of the work, remove the paper and properly clean the fixtures
- E. This section shall be responsible for the protection of the fixtures until acceptance by Owner. Replace damaged fixtures at no additional cost to the Owner.
- F. Floor mount all mop sinks in custodial closets or areas.
- G. Install lavatory carriers on all lavatories in toilet rooms, individually and group facilities.

END OF SECTION



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Specifications

SECTION 15450  
PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Water heaters

1.2 REFERENCES

- A. ASHRAE 90A - Energy Conservation in New Building Design
- B. ASME Section 8 D – ASME Boiler & Pressure Vessels Codes
- C. NFPA 30 - Flammable and Combustible Liquids Code
- D. NFPA 54 - National Fuel Gas Code
- E. NFPA 58 - Storage and Handling of Liquefied Petroleum Gases
- F. NFPA 70 - National Electrical Code
- G. UL 174 - Household Electric Storage Tank Water Heaters
- H. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters
- I. FBC Florida Building Code

1.3 SUBMITTALS FOR REVIEW

- A. Division 1 – Submittals Procedures
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Provide electrical characteristics and connection requirements.
- C. Shop Drawings:
  - 1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.

1.4 SUBMITTALS FOR INFORMATION

- A. Division 1 – Submittals Procedures, procedures for submittals.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 1 - Contract Closeout, procedures for submittals.
- B. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

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Specifications

- C. Warranty: Submit manufacturer's warranty in Owner's name and registered with manufacturer.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
  - 1. American Gas Association (AGA)
  - 2. National Sanitation Foundation (NSF)
  - 3. American Society of Mechanical Engineers (ASME)
  - 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI)
  - 5. National Electrical Manufacturers' Association (NEMA)
  - 6. Underwriters Laboratories (UL)
  - 7. American National Standards Institute (ANSI)
    - a. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25% of midpoint of published maximum efficiency curve.

#### 1.7 REGULATORY REQUIREMENTS

- A. Conform to AGA, ANSI 2 21.22, NFPA 54, NFPA 70, UL 174, UL 1453 requirements for water heaters.
- B. Conform to ASME Section 8 D for manufacture of pressure vessels for heat exchangers.
- C. Conform to ASME Section 8 D for tanks.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 1 - Material Equipment and approved equals: Transport, handle, store, and protect products.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

#### 1.9 WARRANTY

- A. Division 1 - Warranties.
- B. Provide 5-year manufacturer warranty for domestic water heaters, packaged water heating systems.

#### 1.10 MAINTENANCE PRODUCTS

- A. Division 1 - Operation and Maintenance Data.

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Specifications

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. All manufacturers shall be a United States based company doing business in the U.S. for at least 10-years.
- B. Acceptable Manufacturers:
  - 1. Lochinvar
  - 2. Ruud/Rheem
  - 3. A.O. Smith

2.2 RESIDENTIAL ELECTRIC WATER HEATER

- A. Type: Automatic electric vertical storage.
- B. Performance:
  - 1. Minimum recovery rate per design documents with 100°F temperature rise.
  - 2. Maximum working pressure is 150 psig.
- C. Tank: Glass lined welded steel, thermally insulated with 1-inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
- D. Controls:
  - 1. An automatic water thermostat with adjustable temperature range from 120° to 170°F, flanged or screw-in nichrome elements, enclosed controls, electrical junction box, and operating light.
  - 2. Wire double element units so elements do not operate simultaneously.
- E. Accessories:
  - 1. Brass water connections, dip tube, drain valve, magnesium anode, thermometer, and ASME rated temperature and pressure relief valve.
  - 2. ANSI rated vacuum relief valve if required, expansion tank if required.
  - 3. Emergency drain pan.

2.3 COMMERCIAL ELECTRIC WATER HEATERS

- A. Type: Factory-assembled and wired electric vertical storage.
- B. Performance:
  - 1. Minimum recovery rate per design documents with 100°F temperature rise.
  - 2. Maximum working pressure is 150 psig.
- C. Tank: Glass lined welded steel; 4" diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

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- D. Controls: Provide an automatic immersion water thermostat with externally adjustable temperature controls ranging from 60° to 180°F, a flanged or screw-in nichrome element, and a high temperature limit thermostat.
- E. Accessories:
  - 1. Brass water connections, dip tube, drain valve, magnesium anode, thermometer, and ASME rated temperature and pressure relief valve.
  - 2. ANSI rated vacuum relief valve if required, expansion tank if required.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install water heaters and water softeners in accordance with manufacturer's instructions.
  - 1. In addition, install water heaters to applicable AGA, ANSI, NFPA 54, UL requirements.
- B. Coordinate with plumbing piping and related fuel piping, gas venting and electrical work to achieve operating system.
- C. Domestic Water Heater Exchangers:
  - 1. Install domestic water heater exchangers with clearance for tube bundle removal without disturbing other installed equipment or piping.
  - 2. Support unit on pipe stand.
  - 3. Pipe relief valves and drains to nearest floor drain.
  - 4. Provide steam traps and valves as indicated.
  - 5. Pitch shell for condensate drain to traps.

#### 3.2 DEMONSTRATION AND TRAINING

- A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative.
  - 1. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.
  - 2. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans.
- B. Demonstration and Training shall be provided for the following equipment:
  - 1. Domestic Hot Water Heaters
  - 2. Packaged Water Heating Systems

END OF SECTION

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Specifications

SECTION 15535  
REFRIGERATION PIPING

PART 1: GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Filter-driers.
- F. Brazing Materials.

1.02 REFERENCES

- A. ANSI/ARI 710 - Liquid Line Dryers.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 34 - Number Designation of Refrigerants.
- D. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ANSI/ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
- F. ANSI/ASME B31.5 - Refrigeration Piping.
- G. ANSI/ASME B31.9 - Building Services Piping.
- H. ANSI/ASTM B32 - Solder Metal.
- I. ANSI/AWS A5.8 - Brazing Filler Metal.
- J. ANSI/AWS D1.1 - Structural Welding Code, Steel.
- K. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.03 SUBMITTALS

- A. Submit shop drawings under provisions of Division One.
- B. Submit shop drawings indicating layout of piping system, including accessories equipment, traps, critical dimensions, and sizes down to a scale of 1/4 inch equals 1 foot. Provide certification by the equipment manufacturer that piping is properly sized and arranged for oil return and system operation.

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- C. Submit product data under provisions of Division One.
- D. Submit product data indicating general assembly of specialties, including manufacturer's catalogue information.
- E. Submit manufacturer's installation instructions under provisions of Division One.
- F. Submit design data as a submittal under provisions of Division One.
- G. Submit manufacturer's data indicating pipe sizing.
- H. Submit test reports under provisions of Division One.
- I. Submit Test reports indicating results of leak test, acid test.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit documents under provisions of Division One.
- B. Accurately record exact locations of equipment and refrigeration accessories on record drawings.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ANSI/ASME B31.9.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division One.
- B. Deliver and store piping and specialties in shipping containers with labeling in place.
- C. Store and protect products under provisions of Division One.
- D. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2: PRODUCTS

2.01 PIPING

- A. Copper Tubing: ASTM B280, Type ACR hard drawn copper for exposed/accessible lines. Type ACR soft drawn (annealed) for piping below slabs, and grade installed without joints.
  - a) Fittings: ANSI/ASME B16.22 wrought copper.
  - b) Joints: ANSI/AWS A5.8 BCup silver braze.
- B. Brazing Compound: Minimum of 15% silver with melting point greater than 1000 degrees.

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Specifications

2.02 REFRIGERANT

- A. Coordinate with equipment furnished under other sections.

2.03 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator and plastic cap; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.04 VALVES

- A. Packed Angle Valves: Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- B. Packed Ball Valves: Two piece forged brass Body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

2.05 FILTER-DRIERS

- A. Replaceable Cartridge Angle Type: ANSI/ARI 710, UL listed, brass shell and bronze cap, perforated brass shell and molded desiccant filter core; for maximum working pressure of 350 psi.

PART 3: EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, parallel to building structure, 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 and locations. Slope piping one percent in direction of oil return. Provide traps, double risers and similar piping configurations as required to ensure proper oil return.
- E. Provide non-conducting dielectric connections when joining dissimilar metals.

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- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Nitrogen purge lines during brazing.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access to concealed valves and fittings.
- I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.
- K. Insulate piping; refer to Section 15252.
- L. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- M. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- N. Fully charge completed system with refrigerant after evacuation and testing. Take precautions so as not to discharge refrigerant into atmosphere.

3.03 APPLICATION

- A. Provide line size liquid indicators in main liquid line leaving condenser. Install moisture indicator so it can be viewed from service area.
- B. Provide replaceable cartridge filter-driers, with three-valve bypass assembly. Provide filter-driers for each refrigeration circuit.
- C. Provide refrigerant charging valve connections in liquid line between receiver shut-off valve and expansion valve.

3.04 FIELD QUALITY CONTROL

- A. Field testing will be performed under provisions of Division One.
- B. Test refrigeration system in accordance with ANSI/ASME B31.5.
- C. Pressure test system with small amount of refrigerant and dry nitrogen 200 psi. Using halide torch or electronic leak detector check for leaks. Perform final test at 30 inches vacuum for a 24 hour period with no deviation. Provide notification a minimum of 48 hours prior to test and submit written report to Architect verifying test results.



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- D. Start-up of system shall be done in the presence of the equipment manufacturer. A field start-up report shall be submitted to the Architect/Engineer indicating the amount of refrigerant and oil added to the system, operating pressures and temperatures, control and operational checkout and similar features of the installation.

END OF SECTION

SECTION 15671  
AIR COOLED CONDENSING UNITS

PART 1: GENERAL

1.1 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.
- B. Refer to Section 15000, "General Provisions", paragraph entitled, "Anchoring of Equipment for additional requirements regarding the construction and mounting of equipment installed outdoors.

1.2 SCOPE

- A. Provide material, equipment, labor and supervision necessary to install air cooled condensing units.
- B. Unit ratings, capacities, and characteristics shall be as scheduled on Drawings.

1.3 STANDARDS

- A. Performance shall be in accordance with the applicable ARI 210/240 Standards.
- B. Compressor motors, starters, wiring and control wiring shall all conform to NEMA, ETL, NEC, and local utility requirements.

1.4 SECTION INCLUDES

- A. Outdoor condensing unit package.
- B. Charge of refrigerant and oil.
- C. Controls and control connections.
- D. Refrigerant piping connections, and refrigerant circuit controllers.
- E. Motor starters.
- F. Electrical power connections.

1.5 SUBMITTALS

- A. Submit shop drawings indicating components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units and accessories required for complete system.

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1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.7 WARRANTY

- A. Provide five year extended compressor replacement warranty (parts only).
- B. First Year Warranty: Include material coverage for refrigerant compressors, condenser coils, fans, controls electrical devices and related system components.

1.8 MANUFACTURERS

- A. Provide products by one of the following:
  - 1. Trane
  - 2. Carrier
  - 3. Engineer approved equal.

PART 2: PRODUCTS

2.1 CONDENSING UNITS

- A. Type:
  - 1. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, and screens. Provide expansion valves and check valves for split-system heat pump unit.
  - 2. Construction and Ratings: In accordance with ARI 210/240. Testing shall be in accordance with ASHRAE 14.
  - 3. Performance Ratings: Energy Efficiency Rating EER not less than prescribed by ANSI/ASHRAE 90A, and the "Energy Efficiency Code for Building Construction", minimum of 13.0.
  - 4. See Schedule on Drawings for unit capacities, electrical characteristics and performance criteria.
  - 5. Provide with a holding charge of refrigerant and oil.
- B. CASING
  - 1. House components in welded frame with 18 gauge zinc coated galvanized steel frame and panels with weather resistant, baked enamel finish, with 500 hours salt spray test.

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2. Mount contactors and controls in weatherproof panel provided with full opening access doors.

C. CONDENSER COILS

1. Coils: Aluminum fins mechanically bonded to seamless aluminum or copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and dehydrate. Seal with holding charge of nitrogen or refrigerant.
2. Corrosion Protection: Coils shall be protected from corrosion using a factory applied or field applied finish rated for 5,000 hour salt spray test.

D. FANS AND MOTORS

1. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.
2. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in thermal overload protection. Motors shall be either sleeve or ball bearing type.

E. COMPRESSORS

1. Construction: Direct-drive, hermetic, reciprocating type with centrifugal oil pump providing positive lubrication to moving parts, and automatic type pistons. Motor shall be suction gas cooled with internal temperature and current sensible overloads.
2. Mounting: Statically and dynamically balance rotating parts and mount on spring or rubber-in-shear vibration isolators. Internally isolate motors on springs.
3. Capacity Modulation: Single stage.
4. Crankcase Heater: Evaporates refrigerant returning to crankcase during shut down. Energize heater continuously and when compressor is not operating.
5. High and low pressure cut-out devices.

2.2 CONTROLS

- A. Controls shall be of the electro-mechanical type and include contactors, transformers, fusing and interconnecting power and control wiring for complete automatic operation of the unit.
- B. A terminal strip shall be provided for interface to AHU system controller.

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PART 3: EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install equipment in accordance with manufacturer's instructions.
- B. Provide for connection to electrical service. Refer to Division 16.
- C. Install units as indicated.
- D. Provide connection to refrigeration piping system, branch circuit controller and evaporators.
- E. Comply with ANSI/ASHRAE 15.

3.2 CONTRACTOR'S FIELD SERVICES

- A. Prepare and start systems.
- B. Supply initial charge of refrigerant and oil for each refrigerant circuit. Replace losses of refrigerant and oil.
- C. Inspect and test for refrigerant leaks quarterly during first year of operation. Repair all leaks and replace losses of refrigerant and oil to meet manufacturer's specifications.

END OF SECTION

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SECTION 15855  
AIR HANDLING UNITS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide material, equipment, labor and supervision necessary to install Air Handling Units.

1.03 STANDARDS

- A. Units shall have certified ratings complying with ARI Standard 430.
- B. Units shall meet the intent of ASHRAE Standard 62-2007.
- C. Certified in accordance with UL Standard 1995, Safety Standard for Heating and Cooling Equipment.

1.04 QUALIFICATIONS

- A. Units shall be of the modular component type with self-supporting frames equal to:
  - 1. Trane
  - 2. Approved Engineer Equal

1.05 SUBMITTALS

- A. Submittal data shall consist of drawings showing unit dimensions, construction materials, fan performance curves, coil performance (capacity), damper leakage rates horsepower, electrical characteristics and installation instructions.
- B. Fan manufacturers shall furnish for approval for each fan, certified sound power ratings with an octave band analysis and also the volume-pressure-horsepower characteristic curves from shut-off to free delivery.
- C. Where equipment other than the basis of design is submitted equipment room shop drawings including plan and section views drawn to a scale not less than that used on the drawings shall be submitted (1/4" = 1'-0" minimum) with equipment information. Drawings shall clearly indicate all piping, ductwork, access doors, coil pull, filter pull and similar details to a degree not less than that shown on the contract documents. Air handling unit data submitted for approved alternate manufactures without equipment room shop drawings will not be reviewed by the Engineer - No Exceptions.
- D. All equipment data and calculations shall be submitted with the air handling equipment for review. Temperature differences shall not vary more than +/- 10 percent from scheduled data. Total and sensible coil capacities shall meet or exceed scheduled data.

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PART 2: PRODUCTS

2.01 GENERAL

- A. Unit shall be factory built components and assembled as indicated.
- B. Units shall have capacities, arrangements, ratings and performance as scheduled.
- C. Unit components shall be catalogued products of the air handling unit manufacturer. Motors, drives, and dampers shall be factory mounted within modular components.

2.02 CASINGS

- A. All casings of all units including fan, coil, filter, and access sections shall be constructed of internally insulated double-wall sandwich construction of the best quality galvanized steel (G-90) reinforced for maximum rigidity with steel angle framework as required with thermal break. Insulation shall be two inch thick foam insulation (R = 13) with all connecting channels insulated to prevent sweating. Provide additional rigid type external insulation where required to prevent sweating. Unit casings shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610-degrees F.
- B. Belt guards shall totally enclose all moving parts, located outside of the unit.
- C. The casing shall be designed for the design pressure equal to the negative of the maximum static pressure differential between the highest peak on the selected fan characteristic curve and ambient pressure. The casing shall be furnished with lifting lugs or other attachments to facilitate handling. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- D. Drain pan shall be double wall stainless steel 304 construction and provided under the complete fan and coil section for horizontal units and under the complete coil section for vertical units. Drain pans shall be positively sloped to the drain connection. Drain pans shall be insulated with 1" insulation between the two pans.
- E. Unit access to all components is "front access".

2.03 FANS

- A. All fans and shafts shall be manufactured by the unit manufacturer. Fan wheels shall be constructed of galvanized steel, of the type scheduled.
- B. All units shall have internally mounted bearings. Internal bearings shall be provided with extended grease lines. Motors shall be mounted internally.
- C. Fan housings shall be die-formed with streamlined inlets and side sheets. Bearings shall be grease lubricated ball bearings selected for an L-10 rating life of not less than 130,000 hours for direct connected service and not less than 42,500 for belt connected service.
- D. Fans shall be statically and dynamically balanced and factory run tested, in the unit.

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2.04 COILS

- A. Coils shall be furnished for cooling media as scheduled. Coils shall be fully contained within the unit casing. Scheduled coil face velocities shall not be exceeded.
- B. Coils shall be aluminum plate fin copper tube type. Fins shall have drawn, belled, collars bonded to the tubes by means of mechanical expansion of the tubes. Coil casings shall be galvanized steel.
- C. Coils with dual circuits shall have interlaced circuitry.
- D. Coil shall be helium leak tested.
- E. Coil shall be furnished with a factory installed thermostatic expansion valve. The sensing bulbs shall be field installed on the suction line immediately outside the cabinet.

2.05 MOTORS AND DRIVES

- A. Motors shall be NEMA Standard, open drip-proof, energy efficient, minimum 86 percent efficiency, normal torque, 40°C rise, splash-proof, of horsepower rating and electrical characteristics as scheduled on drawings.
- B. Drives shall be rated at 1.25 x the motor horsepower rating. Drives shall be adjustable speed drives for adjustment within plus or minus 10 percent of specified RPM.
- C. Motor shall be mounted on an adjustable mount, suitable for adjusting belt tension and drive alignment.
- D. Furnish and install motor access doors to allow for maintenance and motor replacement.
- E. Motor shall be premium efficiency.

2.06 INSULATION

- A. Shall be provided between dual wall casings as specified under Paragraph 2.02 for applicable units.

2.07 FILTERS

- A. AHU's shall include 1-inch, pleated panel filters with an ASHRAE efficiency of 30-percent and MERV rating of 7 to fit unit dimensions.
- B. Units shall include a clogged filter switch.

2.08 CONTROLS

- A. Controls shall be of the microprocessor type and include contactors, transformers, fusing and interconnecting power and control wiring for complete automatic operation of the unit. Controls shall include solid-state compressor overload protection, high-low pressure cutouts, charge isolation, reset relay and anti-recycle compressor timer.



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- B. The unit manufacturer is responsible for providing the sequence of operation shown on the documents.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Lay out exact location for stands and furnish to General Contractor a dimensional drawing showing stand sizes and locations.
- B. Install units and make piping and duct connections.
- C. Extend condensate drain line from drain pan, through a trap, to the nearest hub drain and elbow into drain. Contractor shall provide sufficient height between drain pan and condensate drain trap to allow drainage against negative fan pressure.
- D. Do not operate units for any purpose until ductwork is clean, filters are in place, bearings lubricated, and the fan has been test run under observation.
- E. Install vibration isolators if internally isolated units are not used.
- F. Units shall be mounted on a pre-manufactured 24-inch high aluminum support stand sized for unit dimensions.

END OF SECTION

SECTION 15858

FANS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide material, equipment, labor and supervision as necessary for complete installation of the fans.

1.03 STANDARDS AND CODES

- A. All fans shall be tested and rated in accordance with AMCA Standard 210 and the Certified Rating Program and shall bear the AMCA Certified Rating Seal.
- B. Fans shall be UL listed and labeled.

1.04 QUALIFICATIONS

- A. Fans shall be by Greenheck, Penn Ventilator, Acme or Cook.

1.05 SUBMITTALS

- A. Shop drawings shall include the following information:
  - a) Fabrication details, material specifications, dimensions.
  - b) Factory certified air performance data.
  - c) Guaranteed sound power output. Tests of sound power shall be performed in accordance with AMCA 300.

PART 2: PRODUCTS

2.01 IN-LINE FANS

- A. Fans shall be complete factory assembled units including housing, supports, frame, fan wheel, vibration isolators motors, and belt drive with adjustable sheaves.
- B. Housing shall be heavy gauge galvanized steel or aluminum with integral inlet and discharge collar. Housing shall be internally insulated. Painted steel housings are not acceptable.
- C. Fan wheels shall be backward inclined centrifugal type, aluminum construction, statically and dynamically balanced.

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- D. Motors shall be permanently lubricated, heavy duty ball or pillow block bearings, and electrical characteristics scheduled. A belt guard motor cover shall be provided.
- E. Drives shall be sized for 150 percent of the driven horsepower, pulleys shall be cast iron, and the motor pulley shall be adjustable.
- F. A disconnect switch shall be provided.
- G. Basis of Design – Greenheck “SQ” Series.

2.02 GENERAL

- A. For belt driven fans, a drive change-out (pulleys and belts) shall be included in the base contract.
- B. Fans shall be UL listed.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install flexible connectors at duct connections to fans. Flexible connectors shall meet requirements of NFPA 90A.
- B. Coordinate with actual fans furnished and ductwork shop drawings.
- C. Coordinate location of fans to allow for access and maintenance.

END OF SECTION

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SECTION 15890

DUCTWORK

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide material, devices, labor and supervision necessary to fabricate and erect ductwork. All ductwork to be sealed airtight.
- B. Store ductwork not less than 6 inches above grade, protected from the elements with plastic sheeting. Protect ductwork from debris generated during construction. Comply with specified SMACNA cleanliness level.
- C. Clean duct systems after installation.
- D. Prepare coordination drawings for HVAC ductwork.
- E. Prepare duct surfaces for painting where run exposed in occupied spaces.
- F. Perform ductwork leakage testing.
- G. Correct deficiencies identified by the Owners Testing and Balancing Agency.

1.03 STANDARDS

- A. Ducts, plenums, metal gauges, reinforcing, methods of supporting and hanging, sealing and other sheet metal work as called for shall be in accordance with the following standards:
  - 1) SMACNA "HVAC Duct Construction Standards Metal and Flexible", 2<sup>nd</sup> Edition, 1995.
  - 2) UL Fire Resistance Directory, latest edition.
  - 3) ASHRAE Fundamentals - 1997, Chapter 32.
  - 4) SMACNA "Duct Cleanliness for New Construction Guidelines" 2000.
  - 5) Florida Building Code Mechanical – Chapter 6.
  - 6) Florida Energy Code
- B. Air conditioning, heating and ventilating system ductwork construction and installation shall conform to requirements of NFPA Bulletin No. 90-A, "Air Conditioning and Ventilating Systems".

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- C. Where requirements contained in these specifications or the drawings are more strict, they shall take precedence over the above referenced Standards.

1.04 QUALIFICATIONS

- A. Shop fabricated sheet metal work shall be constructed of prime quality re-squared tight coat G-90 galvanized steel, except where other type material is specified herein. Manufacturer's name and U.S. gauge number shall appear on each sheet.
- B. Double wall rectangular ductwork shall be factory fabricated Pittsburg Lock or welded longitudinal seams produced by one of the following:
  - 1. United McGill
  - 2. Metal-Mart
  - 3. Monroe

1.05 PRESSURE CLASSIFICATION

- A. General
  - 1. Ductwork shall be designed in accordance with requirements for the specified SMACNA duct pressure classification. Duct pressure classification shall be as required for the static no-flow pressure available from fan, as otherwise specified herein or a minimum of 2 inches water gauge, whichever is larger. Ductwork shall be sealed to SMACNA Class "A" requirements including transverse joints, fitting connections, spin collars, and seams, for all duct systems including supply, return, outside and exhaust air systems.
- B. System Pressure Definitions
  - 1. Rectangular and round supply ductwork: Fabricate for 2 inches positive water gauge.
  - 2. All return ductwork: Fabricate for 2-inches negative water gauge.
- C. Testing Requirements
  - 1. Systems shall be tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual. Test pressure shall not be less than the design duct pressure class rating with leakage equal to or less than Leakage Class 3.
  - 2. Formal leakage testing for supply ducts downstream of terminal boxes is not required, provided the following criteria are met:
    - a. There are no visible mechanical defects.
    - b. All duct seams, joints, and penetrations are sealed.
    - c. There is no audible leakage.

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- d. There is no noticeable air movement when a hand is placed within 3 inches of any duct surface.
3. Leak testing of all other systems shall be performed in accordance with the procedures of SMACNA, "HVAC Air Duct Leakage Test Manual – 1<sup>st</sup> Edition 1985". All ductwork leak testing shall be witnessed by the Owner's Test and Balance Company. The contractor shall provide not less than seven days prior notice to the Test and Balance firm of the proposed test.

1.06 SUBMITTALS

- A. Submit ductwork shop drawings for all duct systems for the project. The construction documents shall not be reproduced as the basis of the ductwork shop drawings. Where required by Division 1, in addition to ductwork drawings, provide full coordination drawings.
- B. Shop drawings shall show the duct routing, actual duct dimensions, elevations of ducts above finished floor line, dimensions from fixed elements such as columns, walls, beams and slabs, and shall include the location and size of balancing dampers, control dampers, fire dampers, access panels, registers and diffusers.
- C. Plans shall reflect actual equipment being furnished.
- D. Shop drawings shall include Contractor's standard duct and sheet metal fabrication details. SMACNA figures may be submitted to satisfy this requirement, but shall be clearly marked to illustrate what is actually being proposed on this project.
- E. Contractor shall review the Drawings for the work of other trades, and shall coordinate the ductwork drawings with the work for other trades. Layout of the drawings is schematic in nature and does not indicate every bend, offset or fitting which may be required, or necessary to coordinate with existing conditions or other trades, and such work shall be provided at no additional cost to the Owner.
- F. The Contractor shall maintain two sets of record drawings - one in the field, one at their office, which accurately reflects changes to the work and as-installed conditions.
- G. Provide plan work drawing at a scale of at least that used for the Contractor Drawings, but in no case, not less than ¼-inch equals 1-foot.
- H. Submit data for upper attachments to structure and lower attachments to ductwork.
- I. Submit data indicating type of transverse and longitudinal joints to be used on shop fabricated ductwork.

PART 2: PRODUCTS

2.01 LOW PRESSURE DUCTS

A. Rectangular Duct

- 1) Ductwork shall be G-90 galvanized steel except where flexible duct runouts to supply air devices are specifically indicated
- 2) Elbows shall be constructed with centerline radius of not less than 1.5 times the duct width; where space conditions will not permit this radius or where indicated, square elbows with single thickness air turns shall be used.
- 3) Slopes for transitions or other changes in dimension shall be minimum 1 to 3.
- 4) Longitudinal seams for ducts with either dimension exceeding 11-inches shall be of the Pittsburgh Lock Type.
- 5) Minimum duct gauge shall be 24.

2.02 DUCT ACCESSORIES

- A. See Section 15910 of these specifications.

2.03 MISCELLANEOUS MATERIALS

- A. Mill-rolled structural steel shall conform to ASTM A36 and be galvanized with materials conforming to ASTM A123.
- B. Equivalent strength, proprietary design, rolled steel structural support systems may be submitted for approval, in lieu of mill-rolled structural steel.

PART 3: EXECUTION

3.01 INSTALLATION

- A. No ductwork shall be delivered to the jobsite or installed until ductwork submittals including layout drawings have been approved and the facility is in a substantially watertight condition, acceptable to the Architect/Engineer. Comply with SMACNA "Duct Cleanliness for New Construction Guidelines", duct cleanliness level "Advanced".
- B. Ducts shall be installed following essentially lines indicated; install offsets, angles, transitions as may be required to avoid interferences with other work, install streamlined easements around obstructions where necessary to pass obstructions through ducts. Maintain full capacity of ducts at offsets, angles, transitions and easements, except where drawings indicated use of reducing or increasing transitions. Layout shown on the drawings is schematic in nature and does not indicate every bend or offset necessary to coordinate with the building structure and other trades, which shall be identified in the Contractors shop drawing submittal and provided at no additional cost to the Owner.

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- C. Install dampers in all duct systems as required for controlling air volumes to trunk ducts, branch ducts, outlets and inlets. Install splitter type dampers in duct wyes and at streamlined branch takeoffs. Where branch ducts tap off of trunk ducts, install opposed blade volume dampers. Contractor shall install a complete system of dampers as required for balancing air systems.
- D. Install flexible connections in ducts at connections to exhaust fans which could transmit vibrations to the duct systems.
- E. Each duct section shall be rigidly supported from structure. Attach hangers to structure with expansion anchors, concrete inserts, beam clamps or other approved means. Powder activated studs may be used and selected for a four to one safety factor based upon the manufacturers catalogued strength.
- F. Install duct-mounted equipment as specified in other Sections.
- G. Duct sizes shown are net inside dimensions and sheet metal size shall be increased to allow for duct linings.
- H. Specified duct sealant pumped or painted into joints on all ductwork systems, as required, before assembly and painted over after assembly. Sealant shall be allowed to set 48 hours before any air pressure is put on system. All tie bars, bolts and rivets shall be sealed with the specified sealant. Corners on all take-offs, tap-ins, penetrations and joints shall be closed type.
- I. Upper attachments shall be securely fastened to the building structure using load rated fasteners, methods which rely upon friction shall not be used. Upper attachments shall not rely on fasteners that penetrate or attach to metal roof decks. The Contractor is cautioned that many SMACNA illustrations of proposed upper attachments are not acceptable, and the method to be used by the Contractor shall be clearly defined in the shop drawing submittal.
- J. Low pressure ductwork over 30", shall be cross broken or beaded between joints and reinforcing angles. If beading is used, beads shall be on 12" centers. Pocket lock construction of any kind will not be permitted in any ductwork, plenums, casings, etc., all galvanized mild steel.

3.02 CLEANING

- A. Clean duct system to force out accumulated dust. Clean half of the system at a time by forcing all of the air through half of the system. Protect equipment surfaces which could be damaged by excessive dust.
- B. Protect duct systems from entry of dust and debris generated during transportation, storage, installation and construction by providing plastic sheathing over the ends of ducts. Comply with requirements for "Advanced" duct cleanliness level as defined by SMACNA "Duct Cleanliness for New Construction Guidelines".
- C. In the opinion of the Architect/Engineer, where the Contractor fails to protect the ductwork interior during construction, cleaning by mechanical means shall be performed.



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- D. Exterior duct surfaces shall be cleaned of dust and debris.

3.03 IDENTIFICATION

- A. Identify duct systems per specification Section 15085.
- B. In concealed locations above ceilings and in equipment rooms, paint spin-collar damper handles with day-glow paint prior to installation.
- C. Paint interior of duct surfaces that are visible through air devices or louvers flat black. Paint exterior surfaces of exposed to view ductwork as directed by the Architect.

END OF SECTION

SECTION 15910

DUCTWORK ACCESSORIES

PART 1: GENERAL

1.01 SCOPE

- A. The other Contract Documents complement the requirement of this section. The General Requirements apply to the work of this section.

1.02 WORK INCLUDED

- A. Volume control dampers
- B. Air turning devices

1.03 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- B. SMACNA - Low Pressure Duct Construction Standards.

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division One.
- B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers, duct access doors, flexible duct connectors and duct test holes. Provide product data for hardware used.
- C. Submit manufacturer's certified air leakage rates for dampers and access doors.

1.05 MANUFACTURERS

- A. Provide Products meeting the specified requirements provided by the following firms:

-Volume Control Dampers:	Ruskin, National Controlled Air, Nailor, Safe-Air
-Flexible Duct Connections:	Duro-Dyne

PART 2: PRODUCTS

2.01 GENERAL

- A. Duct accessories shall be coordinated with the characteristics of the system for which they are to be installed.
- B. Manufacturers recommendations as to maximum velocities and operating pressure, and pressure differentials shall be followed.

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2.02 VOLUME CONTROL DAMPERS

- A. Manual Volume Dampers shall be single blade type for ducts when either dimension is twelve (12) inches or less. Single blade dampers shall be factory fabricated minimum 22 gauge galvanized steel and equal to Ruskin MD25 with damper, blade, frame, bearings, and continuous d" square plated steel control rod (National Controlled Air Model MBD-57, Nailor Model 1820, Safe-Air Model 612).
- B. Manual Volume Dampers shall be opposed blade type for ducts where both dimensions exceeds twelve (12) inches. Opposed blade dampers shall be factory fabricated and equal to Ruskin MD35 with 16 gauge frame, 16 gauge galvanized steel blades, molded synthetic bearings, d" square control rod, and ½" hex continuous axles (National Controlled Air Model MBD-57, Nailor Model 1820, Safe-Air Model 612).
- C. No splitter dampers shall be used.
- D. Except in spin collars, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, molded synthetic or sintered bronze bearings. On single blade dampers nylon end bearings are acceptable.
- E. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.
- F. Manual dampers for round ducts shall be minimum 20 gauge galvanized frame and blade, d" square control shaft, synthetic molded bearings, Ruskin MDRS25 (National Controlled Air Model MBD-RD-88, Nailor Model 1090-H, Safe-Air Model 610R).

2.03 AIR TURNING DEVICES

- A. Multi-blade device with single thickness vanes. Blades aligned in short dimension; steel construction; with fixed blades, mounting straps. Provide in square elbows on supply, return, exhaust and outside air ducts. Where length of vane exceeds 24 inches double wall type vanes shall be used.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions.
- B. Provide balancing dampers at all necessary points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and/or as required for air balancing. Do not use splitter dampers. Also see floor plans, sections and details for additional damper requirements.
- C. Locate outside air dampers to direct air stream into return air to promote mixing.

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- D. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium pressure fans with vinyl sheet, held in place with metal straps, for insulated duct systems insulate with flexible duct insulation.

END OF SECTION

SECTION 15936

GRILLES, REGISTERS, DIFFUSERS, VENTILATORS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide materials, devices, labor and supervision necessary for the installation of grilles, registers, diffusers, and discharges.
- B. Provide grilles, registers and diffusers as per schedule.

1.03 QUALIFICATIONS

- A. Products by Titus, Krueger, or Price. Design, specification and schedule based on Titus.
- B. Air devices shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

1.04 SUBMITTALS

- A. Submit manufacturer's data for air devices and louvers to include materials of construction, dimensional data, performance and acoustical data.

PART 2: PRODUCTS

2.01 CEILING RETURN AND EXHAUST REGISTERS

- A. Ceiling return and exhaust registers shall be provided with devices including scheduled opposed blade volume control where noted or required for balancing.

2.03 MATERIAL

- A. All devices shall be constructed of aluminum.

2.04 FINISH

- A. Provide baked enamel factory finish as scheduled, color to match ceiling grid.

PART 3: EXECUTION

3.01 INSTALLATION

- A. In grid panel type ceilings, acoustical, etc., grilles, registers and diffusers shall be located in the center of the panel.

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- B. Coordinate location of ceiling diffusers and registers with Architect's reflected ceiling plan. Locate devices in a symmetrical pattern.
- C. Paint inside of ductwork visible through grilles or diffusers flat black.
- D. Confirm mounting of all devices prior to order. Where lay-in mounting is indicated, confirm grid dimensions (i.e. narrow-line grid) prior to order.
- E. Adjust throw patterns to eliminate drafts.

END OF SECTION

SECTION 15991

TESTING, ADJUSTING AND BALANCING (TAB) OF HEATING, VENTILATING & AIR CONDITIONING  
(HVAC) SYSTEMS

PART 1: GENERAL

1.01 SCOPE OF SERVICES:

- A. The TAB Consultant shall be a firm certified by either the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).
- B. The TAB Consultant shall provide all technically qualified personnel, equipment, instrumentation, and materials on a continuous basis in order to complete TAB services in a timely manner.
- C. The scope of services shall include, but not be limited to, the following:
  - 1. Review Project Documents to ascertain that the HVAC systems are designed in such a manner that TAB may be accomplished.
  - 2. Provide pre-TAB inspections of the HVAC systems during construction to assure that the systems are installed in conformance with Project Documents and approved shop drawings.
  - 3. Perform TAB of the HVAC systems in accordance with industry standards, and submit certified TAB Report.
  - 4. Provide a Certificate of Conformance or similar guarantee attesting to the performance of the services provided.
  - 5. Calibration measurements for all automatic temperature control devices, maintenance of temperature setpoints and confirmation of control sequences.
  - 6. Owner's representative to witness ductwork pressure testing.

1.02 REFERENCES

- A. Associated Air Balance Council (AABC) - National Standard for Field Measurement and Instrumentation, Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB) - Procedural Standard for Testing, Balancing, and Adjusting of Environmental Systems, latest edition.
- C. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE) - HVAC Systems and Applications Handbook, Testing, Adjusting and Balancing, latest edition.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) - HVAC Systems Testing, Adjusting and Balancing, latest edition.

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1.03 FIRMS

- A. Provide services by one of the following firms (No substitution):

Dade Test and Balance  
Perfect Test & Balance

1.04 SUBMITTALS

- A. Submit pre-TAB inspection reports.
- B. Submit certified TAB report for all HVAC systems.
- C. Submit certificate of conformance attesting to full completion of the TAB work in accordance with the standards and requirements of the certifying agency (AABC or NEEB).

1.05 INSTRUMENTATION

- A. All instrumentation shall be provided by the TAB firm.
- B. Instrumentation used shall be calibrated by a certified firm at a frequency not less than the prescribed by the certifying agency, but in no case more than annually.

1.06 DOCUMENTS

- A. The Contractor shall furnish the TAB firm with a complete set of construction documents and HVAC system shop drawings.

PART 3: PRE-TAB INSPECTIONS

3.01 Provide periodic inspections during construction and written report of findings submitted to the Owner, Contractor and Engineer within seven (7) calendar days after each inspection. The frequency of inspections shall be determined by the TAB Consultant to provide adequate inspection coverage but shall NOT be less than monthly during HVAC system installation. Inspection reports shall define area inspected and shall itemize TAB punch items.

3.02 Inspections shall include, but not be limited to, the following areas:

- A. Ductwork Systems (Supply Air, Exhaust Air, etc.): Verify the proper installation of duct fittings, balancing devices, access doors, turning vanes, transitions, flexible connections, etc, and that the materials, products and routing is in compliance with approved shop drawings.
- B. HVAC Equipment: Verify that the manufacturer, model number, power supply, motor horsepower, accessories, etc. are per approved shop drawings. When shop drawings of a different manufacturer than scheduled in the Project Documents are approved, the data per the shop drawings shall be listed in the TAB report as design data. Verify that the motor starter's overload protectors are correct for the motor's rated load amperes.



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- C. Installation of HVAC Equipment: Verify that the installation is per Project Documents and/or manufacturer's recommendations per approved shop drawings.

3.03 Distribute inspection schedule and inspection reports.

PART 4: TAB WORK

- 4.01 Coordinate TAB work schedule through the Contractor, with the HVAC work being performed under Division 15.
- 4.02 Provide personnel on a continuous basis in order to complete the TAB work in a timely manner. The TAB work shall be completed before Owner occupancy. After Owner occupancy, access to occupied areas may be restricted and work schedules shall be modified accordingly. Work after normal business hours shall be coordinated with the Owner's project manager.
- 4.03 Inform the Contractor on a regular basis of work progress, work schedules and potential problem areas which may delay the timely completion of TAB work.
- 4.04 Permanently mark the final position of dampers and valves.

PART 5: TAB REPORT

- 5.01 Publish a preliminary TAB report within five (5) calendar days prior to the AHCA 100% construction inspection. The publishing of the preliminary TAB report shall not be delayed for unresolved punch items. Measured data for non-complying systems shall be provided so that all parties are working with the same information to resolve outstanding items.
- 5.02 Publish a corrected report, certified by the Test and Balance firm as being an accurate representation of the data gathered, and submit to the Engineer for review.
- 5.03 Publish a final report, certified by the Test and Balance firm as being an accurate representation of the data gathered, with a certificate of conformance after successful completion and AHCA acceptance of the project.

PART 6: TAB REPORT REQUIREMENTS

- 6.01 Provide reports in hard cover, letter size, 3-ring binders with identification on front and binder. Include set of reduced HVAC floor plans with air outlets and equipment identified to correspond with Test Reports. Include pump and fan curves with operating conditions marked.
- 6.02 Fans
- A. Provide test reports in the following order:
1. Fan Test Report
  2. Air Outlet Test Report: Provide for fans with multiple air outlets. Note any outlet with an objectionable noise level.

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6.03 Report Forms

- A. Submit test reports on standard AABC, NEBB or SMACNA forms. Forms shall be expanded to include all data listed, as well as any required data not listed. Each test report shall bear the name of the person who recorded the data, the date when the data was recorded, and the seal of the supervisor. Test reports shall be computer generated.
  
- B. Title Page
  - 1. Date
  - 2. Project's name and address
  - 3. Architect's name and address
  - 4. Mechanical Engineer's name and address
  - 5. General Contractor's name and address
  - 6. Mechanical Contractor's name and address
  - 7. TAB Consultant's name, address and phone number
  
- C. Certification Page
  - 1. Project's name and address
  - 2. Certification statement
  - 3. TAB Consultant's name
  - 4. TAB supervisor's name
  - 5. Certification number
  - 6. Date
  - 7. Seal and signature of TAB supervisor
  
- D. Instrument Calibration Report
  - 1. Instrument
  - 2. Manufacturer
  - 3. Model number
  - 4. Serial number
  - 5. Range
  - 6. Calibration date
  
- E. Fan (Ventilation, Return, Exhaust, Relief) Test Report
  - 1. Fan Data
    - a. Mark
    - b. Location
    - c. Manufacturer
    - d. Model number
    - e. Serial number
    - f. Type: Cabinet, inline, roof mounted, wall mounted
    - g. Wheel type: forward curve (FC), airfoil (AF), backward incline (BI)
    - h. Wheel diameter, IN
    - i. Sheave diameter and bore, IN
    - j. Number of belts, manufacturer and size
    - k. Note any abnormal vibration.

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2. Motor Data
    - a. Manufacturer
    - b. Frame size
    - c. Nameplate HP, volts, amps, phase, RPM and service factor
    - d. Sheave diameter and bore, IN
    - e. Motor sheave to fan sheave center line distance, IN
    - f. Starter size and overload element capacity, amps
  3. Performance Data (Design and Actual)
    - a. CFM
    - b. Fan RPM
    - c. Fan suction static pressure, IN WC (Actual)
    - d. Fan discharge static pressure, IN WC (Actual)
    - e. Fan total static pressure, IN WC
    - f. Motor volts T1-T2, T2-T3, T3-T1
    - g. Motor FLA T1, T2, T3
    - h. Motor no load amps T1, T2, T3 (belt drives only) (Actual)
- F. Air Outlet Test Report
1. Outlet Data
    - a. Mark
    - b. Manufacturer
    - c. Type: Ceiling diffuser (CD), sidewall grille (SG), exhaust grille (EG), return grille (RG), transfer grille (TG), etc.
    - d. Size, IN
  2. Performance Data
    - a. Design CFM
    - b. Actual CFM
    - c. Note all outlets that are not balanced within +/-10% of design. (Actual CFM-design CFM) x 100/design CFM)
    - d. Note all outlets with an objectionable noise level.
- G. Duct Traverse Test Report
1. Duct Data
    - a. System/Branch
    - b. Size, IN
    - c. Area, SF
    - d. Design airflow, CFM
    - e. Design velocity, FPM
  2. Traverse Data
    - a. Duct static pressure, IN WC

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- b. Air temperature, F
- c. Traverse position, IN
- d. Traverse velocity pressure, IN WC
- e. Traverse velocity, FPM
- f. Average duct velocity, FPM
- g. Measured airflow, CFM

H. Inspections

- 1. Attend Inspection (and re-inspections as necessary) to demonstrate system compliance with design documents. Final report shall be provided for Engineers review a minimum of five (5) days prior to the inspection.

I. Acoustical Data

- 1. In space perceived or identified as "noisy", provide noise level measurements by Octave Bands and plot NC levels.

END OF SECTION

SECTION 15992

TESTS - PIPING SYSTEMS

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

- A. Provide labor, materials and supervision necessary to perform all piping tests for all systems as follows:
  - a) Domestic Water Systems
- B. Additional tests may be specified in other sections. These shall be performed in addition to those specified in this section.
- C. Should governing bodies require tests over and above those specified herein, they shall be performed by the Contractor and certified for approval by such governing bodies or agencies.
- D. Perform additional tests as may be required by utility companies or agencies supplying the particular service such as city water, natural gas, medical gases, etc.
- E. Provide certified test reports for all systems.

1.03 EQUIPMENT

- A. Contractor shall provide all devices, equipment, gases, etc., necessary to make tests required. Devices installed in the work shall not be used for test purposes.
- B. Materials shall be subjected to standard test by manufacturer before shipment.

1.04 GENERAL REQUIREMENTS

- A. Make test during installation and after completion. Tests shall be made at expense of Contractor.
- B. Piping concealed in building construction, chases, etc., shall be proved before being concealed. Contractor failing to make such tests must assume all costs of removing and replacing defective piping and must pay all costs of cutting and repairing building construction made necessary by this neglect to end of guarantee period.
- C. Make tests prior to insulating piping or backfilling of underground work.
- D. Make hydrostatic tests with cold water. The minimum duration shall be four hours.

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- E. Test in presence of Owner's representative, who may direct Contractor to perform tests in presence of some other appointed witness. In no case shall Contractor perform a test without its being witnessed. Contractor will be responsible for correct testing, observation of results, and corrections necessary.
- F. Provisions shall be made so that every item may thoroughly inspected, and in no case shall any part of construction be obscured.
- G. Do not apply test pressures to a hot valve. In event such testing is necessary, install temporary block ahead of valve. Final test of connection against hot valve shall be by examination of work under service pressure.
- H. Any device connected into system which cannot assume test pressure shall be disconnected and protected from damage.
- I. All parts of system under test must be under constant supervision with authority to bleed off excess pressure that may develop. No tests shall remain on work unless continuously attended. Use care so that excess pressure does not develop because of temperature changes.
- J. Work shall be completely leak free at any joint, fittings, accessory, or attachment. If repairs are necessary, re-test work after correction. Correct defects made manifest by these tests before proceeding with other work.

1.05 CERTIFIED TEST REPORTS

- A. For each system tested, provide a certificate testifying that the system was tested as specified and provide the following data:
  - a) Identification of system tested referencing specific equipment connected to system.
  - b) Date tested.
  - c) Test pressure and duration of test.
  - d) Recorded test pressure at end of test.
  - e) Media used for testing.
  - f) List necessary repairs made before the system passed the leak test.
  - g) Signature of Contractor.
  - h) Signature of witness.
  - i) Other data as required by the system specification.

1.06 DOMESTIC WATER SYSTEMS

- A. Hydrostatic test at 125 psig minimum, four-hour duration.

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- B. After test, blow clean with potable water, leave lines clean of all sediment and debris.
- C. Sterilize all lines with chlorine as specified.

END OF SECTION