

Technical Specifications as prepared by DRMP, Inc. bearing the title, GRAYTON BEACH TRANSIT FACILITY, dated JUNE 2023.

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SECTION 22 00 00
PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Section 23 01 00 – Mechanical General Requirements and Section 22 05 00 – Basic Materials and Methods, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Soil, Waste, Drain, and Vent Systems.
- B. Domestic Water Piping System.
- C. Plumbing Fixtures, Specialties, and Equipment

1.3 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.
- B. Include component sizes, rough-in requirements, service sizes, trim, and finishes.
- C. Include certificate of compliance of pipe, fittings, and valves.

1.4 QUALITY ASSURANCE:

- A. Welders' Certification: In conformance with AWS D1.1.
- B. For each product, provide components by same manufacturer throughout

PART 2 – PRODUCTS

2.1 SOIL, WASTE, DRAIN, AND VENT PIPING:

- A. Underground Soil, Waste, Drain and Vent Piping:
 - 1. Polyvinyl Chloride (PVC) pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785 and ASTM D-2665. Fittings shall conform to ASTM D-2665. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564; primer shall conform to ASTM F-656.
- B. Above Ground Soil, Waste, Drain and Vent Piping:
 - 1. Polyvinyl Chloride (PVC) pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D-1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D-1785 and ASTM D-2665. Fittings shall conform to ASTM D-2665. All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements. Solvent cements shall conform to ASTM D-2564; primer shall conform to ASTM F-656.
- C. Gate Valves: Gate valves shall conform to the requirements of UL 262, shall be inside-screw type with operating nut, shall have split wedge or double disc type gate and shall be designed for a hydraulic working pressure of 175 psi. Stuffing boxes shall have O-ring

seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valve ends shall match the piping in which they are to be installed. The valves shall have an indicator post flange where a post indicator as required.

- D. Valve Boxes: Each gate valve shall be provided with an adjustable, two-piece, cast-iron valve box of a size suitable for the valve. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the shaft of the box shall be 5-inches. Each box shall be given a heavy coat of bituminous paint and set in an 18"x 18" x 6" concrete pad.

2.2 INTERIOR DOMESTIC WATER PIPING:

A. Materials:

1. Copper tubing, hard-drawn, Type "L", conforming to ASTM B 88 with cast-brass or wrought-copper sweat joint fittings using ASTM B 32, tin-antimony or Grade Sn96 tin-silver solder, and flux containing not more than 0.2 percent lead; or with ANSI B16.26 flare joint fittings. Piping under concrete slabs shall be copper tubing, soft-drawn, Type "K", conforming to ASTM B 88, without joints.
2. Pipe shall be manufactured from cross-linked polyethylene (PEX) conforming to ASTM F876 & F877. Cold water piping shall be colored blue and hot water piping shall be colored red. Fittings shall be manufactured from solid brass and conform to ASTM F1807. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer. All pipe and fittings shall be manufactured in the United States. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standard 61. Installation shall comply with the latest installation instructions published by the manufacturer.

- B. Water Hammer Arresters: Permanently sealed mechanical device, pre-charged, threaded connection. ASSE 1010 – 2004 certified. Install as close as possible to quick-closing valve. No access panel shall be required. Unit shall be hard drawn sealed copper body with plastic rings and piston, threaded adapter equal to Sioux Chief 650 series.

- C. Ball Valves: Valve shall have two piece forged brass or cast bronze body, blowout proof stem, PTFE seats/seals, chrome plated ball and full port design. Valves sizes 1/4" - 2" shall be pressure rated to 150 WSP/600Wog and conform to MSS-SP 110 and certified to CSA, UL, and FM. Valves Sizes 2 1/2" - 3" shall be pressure rated to 150 WSP/400 WOG and conform to MSS-SP 110. Provide extension through insulation as required. Valve shall be equal to Kitz valve #69.

- A. WC-1 , Watercloset: General Description: 1.6 Gal flush, Vitreous china, elongated bowl, siphon jet action, 1-1/2" to spud, quiet flush valve with a vacuum breaker and 1" angle stop, open front white seat with stainless steel self-sustaining check hinge.

1. Fixture: Equal to American Standard "MADERA" #2234.015
2. Seat: Beneke #523-SS
3. Valve, Electronic, Battery: Sloan top mount solenoid flush valve #G2-8111.

- B. WC-2 , Watercloset for Handicapped: General Description: 1.6 gal flush, Vitreous china, elongated bowl, 18" high, siphon jet action, 1-1/2 top spud, quiet flush valve with vacuum breaker and 1" angle stop, open front white seat with stainless steel self-sustaining check hinge.

1. Fixture: Equal to American Standard "MADERA" #3043.102
2. Seat: Beneke #523-SS

3. Valve, Electronic, Battery: Sloan top mount solenoid flush valve #G2-8111.
- C. UR-1, Urinal: General Description: Vitreous china urinal with integral extended shields, flushing rim, strainer and trap, 3/4" top spud, 2" outlet, wall hanger, and flush valve with angle stop and vacuum breaker.
1. Fixture: American Standard "ALLBROOK" #6541.132
 2. Valve, Manual: Sloan #186-1 flush valve.
 3. Battery Sensor Valve: Sloan top mount solenoid flush valve #G2-8186-1.
- D. L-1, Lavatory: Vitreous china lavatory with back and soap depression, 20" x 18", concealed wall hanger, single faucet, self closing handle with aerator, angle supplies with stops and flexible risers and 1-1/4" cast brass adjustable "P" trap with cleanout and waste to wall.
1. Fixture: American Standard "LUCERNE" #0355.021
 2. Faucet, Battery Sensor: Sloan #EBF-650-BDM
 3. Drain: Dearborn Brass #760-1
 4. P-Trap: Dearborn Brass #707-1
 5. Supply: Brass Craft #OCR1920AZ C
- E. L-2, Lavatory for Handicapped: Vitreous china lavatory, 20" x 27", concealed arms support, single faucet with aerator and 4" wrist blades, offset grid assembly, angle supplies with stops and flexible risers and 1-1/4" cast brass adjustable "P" trap with cleanout and waste to wall.
1. Fixture: American Standard "Wheelchair Users Lavatory" #9140.013
 2. Faucet, Manual ADA: T&S Brass #B0890
 3. Faucet, Battery Sensor: Sloan #EBF-650-BDM
 4. Drain: Dearborn Brass #760W-1
 5. P-Trap: Dearborn Brass #707-1
 6. Pipe Insulation: Lav-Guard 102EZ
 7. Supply: Brass Craft #OCR1920AZ C
- F. Outdoor Showers:
1. Outdoor Shower Company Model WM-442-ADA-FS
 2. Stainless Steel construction
 3. S.S. shower head
 4. S.S. foot shower/rinse
 5. Cold water single supply
 6. ADA metered control valve.
 7. Mounting: use stainless steel stand off anchors, minimum 4 with one at head, one at foot rinse and one each top and bottom of metered valve. Space off wall to allow for water piping to be directed into back of each valve following isolation valve and tee.
- G. PLUMBING SPECIALTIES: Furnish and install the following plumbing specialties:
- H. HB-1, Non-Freeze Hose Bibb: Woodford Model B65 or equal, cast brass, vacuum breaker, heavy duty, wall hydrant with polished brass face, brass working parts, renewable nylon seat, 3/4" NPT hose outlet and T-handle.

- I. HB-2, Hose Bibb (IN RESTROOM): Woodford Model 26-1/2 vacuum breaker, wall hose outlet and T-handle.”
- J. FD-1, Floor Drain: Equal to Josam #30003-A, Smith #2005-A (3") or Zurn #Z415 with Type B strainer. (Equal to Josam #30003-S, Smith #2005-A (3") or Zurn #Z415 with Type S strainer.) square
- K. WH- 1-7, Tankless Water Heater: Heater shall be equipped with a copper sheathed heating element housed in a copper cylinder. The flow switch that operates the heating element shall be of the mechanical pressure differential type. The unit shall be equipped with a safety high-limit switch with manual reset, and a separate self-resetting thermostat designed to keep the water temperature below 130 F. The unit shall have a 40 F temperature increase above ambient at 0.42gpm. The unit shall be single phase 208 volts, 3 kw. The water heater shall be Stiebel Eltron DHC 3-1 or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. General: Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with all local plumbing, building, and fire code requirements. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply. Plastic piping shall not penetrate fire rated walls, floors, or enclosures (including plenums) and shall be used on one side of fire rated partitions not closer than 6 inches to a penetration.

3.2 PREPARATION:

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Verify adjacent construction is ready to receive rough-in work of this Section.

3.3 INSTALLATION:

- A. Install bell and spigot pipe with bell end upstream. Slope pipe in accordance with the requirements of SBCC Standard Plumbing Code.
- B. Tracer wire shall be installed for ductile-iron pipe and fittings in accordance with Section 23 01 00
- C. Install specialties in accordance with manufacturer's instructions.
- D. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- E. Install water hammer arresters complete with accessible isolation valve.
- F. Install each fixture with chrome plated rigid or flexible supplies with stops, reducers, and escutcheons.
- G. Adjust stops or valves for intended water flow rate to fixture without splashing, noise, or overflow.
- H. Install water heaters in accordance with manufacturer's instructions and to [AGA] [NSF] [NFPA] [UL] requirements. Coordinate with plumbing piping and related [fuel piping] [gas venting] [electrical] work to achieve a satisfactory operating system.

- I. There should be a minimum of 30 inches of cover for water mains.
- J. While under construction, unattended exposed pipelines must have the ends capped. All materials to be used in construction shall be stored above the ground in a manner that will minimize the possibility of contamination.
- K. Water mains shall be laid at least 10 feet horizontally from any sanitary sewer or manhole.
- L. Water mains shall be located on opposite sides of the street from sewer where possible.
- M. Where local conditions prevent 10 foot horizontal separation, the water main may be laid closer to the sewer line provided they are in separate trenches with adequate space for maintenance and the bottom of the water line is 18 inches above the top of the sewer line. Where this 10 foot horizontal separation cannot be maintained, the water line should be uctile iron with water line joints located at the maximum distance possible from the sewer ine joints.
- N. Where water lines cross over sewer lines, the pipe segments should be centered to provide maximum spacing of joints. A vertical separation of at least 18 inches should be maintained (water over sewer).
- O. Install tanks in accordance with manufacturer's instructions.
- P. Install heat exchanger with clearance for tube bundle removal without disturbing other installed equipment or piping. Pipe relief valves and drains to nearest floor drain. Clean and flush tanks after installation. Seal until pipe connections are made. Provide heat exchanger with the following accessories:
 - 1. Wells for temperature sensor at heated water outlet.
 - 2. ASME rated pressure and temperature relief valve on heated water discharge.
 - 3. ASME rated pressure relief valves from tapping on heated water side, set at 120 psig.
 - 4. ASME Thermometer and pressure gauge tappings on water inlets and outlets.
 - 5. Drain valve on water inlet and outlet of tank.
- Q. Provide line sized gate valve and strainer on suction and line sized soft check valve and globe valve on discharge of hot water recirculating pump.
- R. Provide protective systems for all trench excavations in excess of 5 feet in depth as described by OSHA Regulation 1926.652: Requirements for Protective Systems.

3.4 FIELD TESTS:

- A. Waste and Drainage Piping: The entire drainage and venting system shall have all necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The system shall hold this water for 30 minutes without showing a drop greater than 4". Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except that a vertical stack 10 feet above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure or a pump may be used to supply the required pressure. The pressure shall be maintained for thirty minutes. Contact the A/E representative for test verification.

- B. Domestic Water Piping: Upon completion of the roughing-in and before setting fixtures, the entire hot and cold water piping system shall be tested at a hydrostatic pressure of not less than 100 pounds per square inch gauge, and proved tight at that pressure. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in the same manner as specified for the entire system. Contact the A/E representative for test verification.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM:

- A. After completion of the construction and pressure testing of water distribution lines, they shall be flushed and disinfected using at least a 50 mg/L free chlorine solution for 24 hours or as described in the latest revision of AWWA C651. Large volume disposal of this water may require a permit from the Department of Environmental Quality/Office of Pollution Control.
- B. After completion of the construction and disinfection of water distribution lines, the contractor shall arrange for at least one microbiological water sample to be collected by a representative of the Mississippi State Department of Health or the Registered Professional Engineer in charge of the project, or the Certified Operator for the system from every dead-end line and every major looped line. Water being collected for testing shall not have chlorine residual higher than is normally maintained in other parts of the distribution system. No chlorine shall be present that is a result of line disinfection. No coli form bacteria and no confluent growth indication shall constitute a satisfactory sample when analyzed by the Mississippi State Department of Health or a laboratory certified by the State.
- C. Backflow Preventers: Provide a state certified tester to certify the backflow preventer operates properly and the results shall be sent to the City Engineer and the Water Department. The backflow preventer state forms shall be completed for proper operation of each device installed.

3.6 SERVICE CONNECTIONS:

- A. Provide new sanitary [and storm] sewer service. Before commencing work check invert and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service with water meter and backflow preventer. [Provide sleeve in wall for service main and supported at wall, caulked and made watertight.] [Provide sleeve around service main to 6 inch above floor and 6 feet minimum below grade.]

END OF SECTION

SECTION 22 05 00
BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Basic Piping Materials and Installation Procedures for All Piping Systems.
- B. Identification, Labeling, and Marking.
- C. Testing, Adjusting, and Balancing.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

- A. Type of pipe and fittings are specified under each piping system.

1.4 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.
- B. Submit pipe hanger and support data along with certificate of compliance.
- C. Submit qualifications of testing and balancing firm.
- D. Include testing and balancing procedures (agenda) along with proposed forms.
- E. Submit final test and balance report.

1.5 QUALITY ASSURANCE:

- A. Agency: Testing and balancing agency shall be a company specializing in this type work for a minimum of three documented years and certified by AABC or NEBB.
- B. Welder Certification: In conformance with AWS D1.1.
- C. For each product, provide components by the same manufacturer throughout.
- D. Use domestic pipe, pipe fittings, valves, and motors on this project when available unless other specified.

PART 2 - PRODUCTS

2.1 BASIC PIPING MATERIALS:

- A. Gate Valves: Valves up to 2-inch size shall have bronze body, bronze trim, inside screw, rising stem with hand-wheel, single wedge or disc, solder or threaded ends, Crane No. 1324, NIBCO No. S-126 or equal. Valves over 2-inches shall have iron body, bronze trim, rising stem with hand-wheel, OS&Y, double wedge, flanged ends
- B. Ball Valves: Valves up to 2-inch size shall have bronze or stainless steel body, stainless steel ball, Teflon seats and stuffing box ring, lever handle, solder or threaded ends. Valves over 2-inch size shall have cast steel body, stainless steel ball, Teflon seat and stuffing box seals, lever handle, flanged ends.

- C. Escutcheon Plates: One piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed spaces, chromium-plated finish on plates in finished spaces, paint on plates in unfinished spaces, and with set screws to anchor plates in place securely.
- D. Unions: For pipe sizes under 2-inches use 150 psig malleable iron unions for threaded ferrous piping; bronze unions with solder joints for copper pipe.
- E. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, except both ends threaded for gas service, water impervious isolation. Use unions as manufactured by EPCO.
- F. Access Doors: Provide, 12" x 12" minimum size, factory prefabricated flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in dry walls, plaster walls, or masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.
- G. Pipe Sleeves: Sleeves in masonry and concrete walls, partitions, floors, and roofs shall be constructed of, Schedule 40, hot-dipped galvanized, pipe conforming to ASTM A53. Sleeves in other type construction shall be constructed of steel sheet having a nominal weight of not less than 0.90 pounds per square foot.
- H. Flashing: Flashing for pipes passing through roof or waterproofing membrane shall be fabricated from 4-pound per square foot sheet lead. Flashing for plumbing vents through metal roof shall be made water-tight by special flashing obtained from the roof manufacture.
- I. Pipe Hangers and Supports: Provide MSS SP-58 and MSS SP-69, Type 1 or 6 of adjustable type. Attachments to steel W or S beams shall be with Type 21, 28, 29, or 30 clamps. Attachments to steel angles and channels (with web vertical) shall be with Type 20 clamp with beam clamp channel adaptor. Attachments to steel (with web horizontal) shall be with drilled hole on centerline and double nut and washer. Attachment to concrete shall be with Type 18 insert or drilled hole with expansion anchor. Attachment on roof shall be structural design with mechanically attached foam base, saddle for aligning pipe, and use of 3/8" or 1/2" threaded rod, equal to Roof Top Blox. Hanger rods and attachments shall be full size of the hanger threaded diameter. Provide Type 40 insulation protection shields for insulated piping. Provide steel support rods. Provide nonmetallic, hair felt or plastic piping isolators between copper tubing and the hangers or use copper hangers.
- J. Tracer Wire for Nonmetallic Pipe: Tracer wire shall be bare copper wire not less than 0.10 inch in diameter and shall be continuous over entire length of nonmetallic pipe.

2.2 Identification:

- A. Stencils: With clean cut symbols and letters.
- B. Stencil Paint: In accordance with Section 09900, semi-gloss enamel.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.3 Adjusting, Balancing & Testing:

- A. General: The Contractor shall procure the services of an independent balance and testing firm, approved by the Architect which specializes in the balancing and testing of

heating, ventilating and air conditioning systems; to balance, adjust, and test the mechanical systems performance in accordance with the contract plans and specifications.

- B. Quality: The testing firm shall be a member of Associated Air Balance Council. All work by this firm shall be done under direct supervision of a qualified engineer employed by them. The air balance firm shall provide proof of having successfully completed at least five projects of similar size and scope. All instruments used by this firm shall be accurately calibrated and maintained in good working order. If requested, the tests shall be conducted in the presence of the Contracting Officer.
- C. Testing: Balance and testing shall not begin until system has been completed and is in full working order. The Contractor shall put all heating, ventilation, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.
- D. Submittal: The Contractor shall submit six (6) copies of submittal data for the testing and balancing of the air conditioning, heating and ventilating systems.
- E. Warranty: Balance firm shall include and extended warranty of 90 days, after completion of work, during which time the Architect, at his discretion, may request a re-check of resetting of any water flow, outlet, supply air fan, or exhaust fan as listed in test report.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING:

- A. Preparation:
 - 1. Ream pipe and tube ends. Remove burrs. Bevel plain end of ferrous pipe.
 - 2. Remove scale and dirt, on inside and outside of piping before assembly.
 - 3. Prepare piping connections to equipment with flanges or unions.
 - 4. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.
- B. Installation:
 - 1. Provide non-conducting dielectric connections whenever jointing dissimilar metals. Locate in accessible locations.
 - 2. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations. Route piping in an orderly manner, plumb, and parallel with the lines of the structure, and maintain gradient.
 - 3. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 4. Install specialties and equipment in accordance with manufacturer's instructions.
 - 5. Install brass male adapters each side of valves in copper piped systems. Sweat solder adapters to pipe.
 - 6. Provide clearance for installation of insulation and access to valves and fittings.
 - 7. Slope water piping and arrange to drain at low point.
- C. Application:

1. Install specialties in accordance with manufacturer's instructions.
2. Install brass male adapters each side of valves in copper piped systems. Sweat solder adapters to pipe.
3. Install globe, plug cock, or ball valves for throttling, by-pass, or manual flow control services.
4. Install tracer wire over underground nonmetallic pipe.
5. Threaded Connections: Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.
6. Solder End Valves: Remove stems and washers and other items subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.
7. Pipe Hangers and Supports: Support horizontal piping as follows:

<u>PIPE SIZE</u>	<u>MAXIMUM HANGER SPACING</u>	<u>HANGER ROD DIAMETER</u>
½ TO 1-1/4 INCH	6'-0"	3/8"
1-1/2 TO 2 INCH	8'-0"	3/8"
2-1/2 TO 3 INCH	10'-0"	½"
4 TO 6 INCH	12'-0"	5/8"
8 TO 12 INCH	14'-0"	7/8"
PLASTIC – ALL SIZES	4'-0" & AT ELBOWS	3/8"
CAST IRON PIPE	5'-0" & AT JOINTS	5/8"

8. Pipe Sleeves: Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and calk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs 3 inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.
9. Flashing: Pipes passing through roof or floor waterproofing membrane shall be installed through lead flashing within an integral skirt or flange. Flashing shall be suitable formed and the skirt or flange shall extend not less than 8-inches from the pipe and shall set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 8-inches. The annular space between the flashing and the bare pipe shall be sealed. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. A sheet-lead flashing

shield shall be provided for floor drains and pipe sleeves with integral clamping devices that penetrate a membrane. Flashing shield shall be made from sheet lead and extend not less than 8-inches from the drain or sleeve in all directions. Flashing shall be inserted into the clamping device and made watertight.

10. Flanges and Unions: Flanges shall be faced true. Flanges shall be provided with gasket and made square and tight. Except where copper tubing is used, union or flange joints shall be provided in each line preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. A union shall be installed on the downstream of each valve.
11. Grading: Connections shall be carefully made to insure unrestricted circulation or flow, eliminate air pockets and permit draining of all systems. Hot and chilled water lines shall have a grade of not less than 1" in 40' up in the direction of flow to the high point air vent. Steam and steam condensate lines shall have a grade of not less than 1" in 20' down in the direction of flow. Use eccentric reducers to maintain top of heating and chilled water piping at proper grade and to maintain bottom of steam and steam condensate piping at proper grade.
12. Valve Stems: Valves in horizontal lines shall be installed with stems horizontal or above.

D. Welding

1. Welded Joints: Welded joints shall be fusion-welded in accordance with ANSI B31.1, Section 6. Mitering or notching of pipe to form elbows or tees or other similar construction will not be permitted.
2. Beveling: Field and shop bevels shall be in accordance with the recognized standards and shall be done by mechanical means or flame cutting. Where beveling is done by flame cutting, surfaces shall be cleaned of scale and oxidation prior to welding.
3. Alignment: Before welding, the components parts to be welded shall be aligned so that no strain is placed on the weld when finally positioned. Height shall be so aligned that no part of the pipe wall is offset by more than 20% of the wall thickness. Flanges and branches shall be set true. This alignment shall be preserved during the welding operation.
4. Removing and Replacing Defective Welds: Shall be at no additional cost to the owner. Repairing defective welds by adding new materials over the defects or by peening will not be permitted.
5. Electrodes: Electrodes shall be stored in a dry heated area and shall be kept free of moisture or dampness during fabrication operations. Electrodes that have lost part of their coating shall be discarded.
6. Welding to Structure: Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

3.2 IDENTIFICATION, LABELING AND MARKING:

- A. General: Piping, valves, controls, and equipment shall be labeled or marked. Manufactured name plates and labels such as Brady or Seton will be acceptable and the Contractor is invited to submit, for examination and test, samples of materials he proposes to use.

- B. Piping: On all piping, stencil name of liquid or gas being handled, and direction of flow in contrasting colors. In general stencils shall be on piping at 20 foot intervals and near all operating valves & equipment. Lines less than 3/4" total diameter to be identified with brass tags, lines 1" to 2" to have 3/4" high stencils, lines 2-1/2" to 7" to have 1-1/2" high stencils and all larger lines to have 2" high stencils. Sizes given are after insulation is applied.
- C. Equipment: All apparatus, equipment, machines, controlling devices, controlled devices, starters, and switches are to be identified by name and number. Do not place label on cover or shield which is removable or interchangeable with other pieces. On all major equipment it shall be painted in prominent spots as selected. Number all boilers, fans, pumps, etc., as well as label.

3.3 TESTING, ADJUSTING, AND BALANCING:

- A. General Requirements: All equipment and apparatus necessary for balancing and testing shall be furnished by the Contractor. All defects disclosed by the tests shall be rectified without additional cost to the Owner. Field tests shall be made under the direction and subject to the approval of the Contracting Officer.
- B. Piping Systems: Shall be tested after installation and before any insulation is applied. All controls and other apparatus that may be damaged by the test pressure shall be removed before the tests are made. Leaking screw and solder joints shall be remade. Welded joint leaks shall be repaired by cutting the section out of the system and rewelded. Tests shall be made by the Contractor and the results submitted for approval. Each system shall be hydrostatically tested as outlined in applicable codes and standards. Test pressure shall be maintained for no less than 2 hours. No tar, grease, paint or any other compound shall be used to repair leaks.
- C. Operational Test: After the above testing all mechanical systems shall be started and operated to prove proper functioning of each type of equipment. Start-up and adjustment of the heat pumps shall be accomplished by the manufacturer's start-up Engineer. All operating tests shall be to the satisfaction of the Architect. Should any element not perform properly, the Contractor shall make all required corrections.
- D. The balance and testing firm shall test, balance, adjust and record the following for all systems as applicable.
 - 1. Test and adjust all blower RPM to design requirements.
 - 2. Test and record all motor full load amperes.
 - 3. Test and record system static pressure, suction and discharge.
 - 4. Test and adjust system for design recirculated air, CFM.
 - 5. Test and adjust system for design CFM outside air.
 - 6. Test and record entering air temperatures.
 - 7. Test and record leaving air temperatures.
 - 8. Test and adjust each diffuser, grilles and register to within ten percent of design requirements. Each grille, diffuser and register shall be identified as to location and area. Size, type, and manufacture of diffusers, grilles, registers, and all test equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculation.

9. In cooperation with the control manufacturer's representative, setting adjustment of automatically operated dampers to operate as specified, indicated and/or noted. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
- E. Performance Test: After completion of testing, balancing and adjusting the balance and testing firm shall make performance test of all mechanical system to determine compliance with the specification requirements. Any equipment that fails to equal or to exceed the specified performance shall be modified or replaced at no additional cost to the Owner.
- F. Test Data: The Contractor shall furnish to the Architect four (4) copies of the schedules of readings taken during the balance and testing operation indicating the required to specified reading and the final balanced reading of all items.

SECTION 23 00 00
HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Variable Refrigerant Flow Systems
- B. Exhaust Fans and Accessories

1.3 QUALITY ASSURANCE:

- A. Fan Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- B. Fan Sound Ratings: AMCA 301; tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
- C. Fan Fabrication: Conform to AMCA 99 and/or ARI 430.

1.4 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.
- B. Submit manufacturer's installation instruction.
- C. Provide one (1) extra set of filters.

PART 2 - PRODUCTS

2.1 Variable Refrigerant Flow Systems

- A. System Description: The variable capacity, heat pump heat recovery air conditioning system shall be Variable Refrigerant Flow System. The system shall consist of the outdoor unit, multiple indoor units, and DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be independently controlled.
- B. Quality Assurance
 - 1. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
 - 2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
 - 3. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
 - 4. The condensing unit shall be pre-charged with R410A refrigerant sufficient for the outdoor unit, indoor units and 164' of total extended piping length.
- C. Delivery, Storage and Handling: Unit shall be stored and handled according to the manufacturer's recommendation.

D. Warranty: The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The compressor shall have a warranty of six (6) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

E. OUTDOOR UNITS:

1. HEAT PUMP :

a)General: The outdoor unit shall be a horizontal discharge, 208/230 volt, single-phase unit. The outdoor units shall be equipped with multiple circuit boards that interface to the controls system and shall perform all functions necessary for operation. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

(i)The sum of connected capacity of all indoor units shall range from 90% to 100% of outdoor rated capacity.

(ii)Outdoor unit shall have a sound rating no higher than 52 dB(A).

(iii)Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated.

(iv)The outdoor unit shall have an accumulator with refrigerant level sensors and controls.

(v)The outdoor unit shall have a high pressure safety switch, low pressure safety switch and over-current protection and DC bus protection.

(vi)The outdoor unit shall have the ability to operate with a maximum height difference of 98 feet and have a total refrigerant tubing length of 393 feet. The greatest length is not to exceed 262 feet between the outdoor unit and the CITY MULTI indoor units and shall not require line size changes nor traps.

(vii)The outdoor unit shall have rated performance for heat operation at 10°F ambient temperature without additional low ambient controls.

(viii)The outdoor unit shall be capable of cooling operation down to 23°F outdoor ambient without additional low ambient controls.

(ix)The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

b)Unit Cabinet: The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

c)Fan:

(i)The unit shall be furnished with two direct drive variable speed motors.

(ii)The fans will be forward curved type blades for quiet operation.

(iii)The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

(iv)The fan motor shall be mounted for quiet operation.

(v)The fan shall be provided with a raised guard to prevent contact with moving parts.

(vi)The outdoor unit shall have horizontal discharge airflow.

d)Refrigerant: System shall use R410A refrigerant.

e)Coil:

(i)The outdoor coil shall be of nonferrous construction with lanced or corrugated fins on copper tubing.

(ii)The coil fins will have a factory applied corrosion resistant blue-fin finish.

(iii)The coil shall be protected with an integral metal guard.

(iv) Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

f) Compressor:

(i) The compressor shall be a single high performance, inverter driven, modulating capacity scroll compressor.

(ii) The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable down to 16% of rated capacity.

(iii) The compressor shall be equipped with an internal thermal overload.

(iv) The compressor shall be mounted to avoid the transmission of vibration.

g) Electrical:

(i) The outdoor unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

(ii) The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

(iii) The outdoor unit shall be controlled by integral microprocessors.

(iv) The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair, non-polar shielded cable to provide total integration of the system.

F. INDOOR UNITS:

1. WALL-MOUNTED INDOOR UNIT

a) General: The unit shall be wall-mounted indoor unit section with a slim silhouette and shall have a modulating linear expansion device. The unit shall be used with the VRF outdoor unit. The unit shall support individual control using DDC controllers.

b) Indoor Unit: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

c) Unit Cabinet:

(i) The casing shall have a white finish.

(ii) Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.

(iii) There shall be a separate back plate which secures the unit firmly to the wall.

d) Fan:

(i) The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.

(ii) The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

(iii) A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

(iv) A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

2.2 EXHAUST FANS AND ACCESSORIES:

A. General: This Contractor shall furnish and install all exhaust fans. Fans shall be of the sizes and types shown on the Drawings and shall be complete with all accessories and specials scheduled. Fans shall be rated in accordance with AMCA Standards and shall be

AMCA labeled. All fractional horsepower motors shall be provided with internal overload protections.

- B. Ceiling Mounted Fans: Fans shall be of the centrifugal direct drive type. Each fan shall have a removable front grille and gravity discharge damper. Interior of fan housing shall be lined with sound deadening insulation. Provide appropriate roof jack or wall discharge grille and connecting ductwork. Fans shall be Greenheck Model SP-A, Cook Model GC, Twin City Fan Model T, Broan, or approved equal.
- C. Wall Caps: Wall caps for ceiling type exhaust fans shall consist of flanged extruded aluminum louver with a wall sleeve and a spring loaded backdraft damper. Caps shall be Greenheck Model WLSP or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Install equipment in accordance with manufacturer's installation instruction.
- B. Coordinate installation with architectural, structural, mechanical, and electrical work.
- C. Pipe drains to floor drain.
- D. Clean and flush system before placing in operation.
- E. Verify that the proper utilities are connected and ready for use before operation of equipment.

END OF SECTION

SECTION 23 01 00
MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. The general provisions of the Contract, including General and Supplementary Conditions, DIVISION 1 - GENERAL REQUIREMENTS, apply to the work specified in this Division, with additions and modifications specified herein.

1.2 APPLICATION: This section applies to all sections of Division 15 - Mechanical Work of these specifications, including modifications and additions specified in each individual section.

1.3 DESCRIPTIONS OF WORK:

- A. Scope: The work covered by this Division of these Specifications consist of furnishing all plant, labor, equipment, appliances, and materials, and in performing all operations in connection with the mechanical work, including all items of special equipment specified herein, complete in strict accordance with this Division of these Specifications and the applicable Drawings.
- B. Work Included: The work involves a complete mechanical system. Generally the work includes, but is not limited to the following items. Complete heating, ventilating and air conditioning system.

- Complete heating, ventilating and air conditioning system

- Hot and chilled water distribution system, including pumps, piping, etc.

- Domestic hot and cold water distribution system.

- Waste and drainage system.

- Plumbing fixtures, appliances, equipment, and specialties.

- Temperature control system and Instrumentation.

- Terminal and acoustical insulation.

- Mechanical rough-in and mechanical connection of equipment furnished under other Divisions of this Contract.

- Maintain a clean work area.

- Testing, adjusting and balancing of the mechanical system.

- Equipment and piping identifications.

- Miscellaneous other work for a complete and operative mechanical system.

- Structural steel for equipment supports.

1.4 Related Work Specified Elsewhere: Generally the following work is specified under other Divisions of the project Specifications.

- A. Electrical power wiring and power connection to equipment.
- B. All painting except restoring finish on equipment that has sustained damage during shipment or installation.
- C. Receiving, uncrating and installing equipment furnished by others or the Owner.

1.5 SITE CONDITIONS: Before submitting a proposal for the work contemplated in these Specifications and accompanying Drawings, each bidder shall examine the site and

familiarize himself with all the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstandings as to the amount of work involved or his lack of knowledge of any condition in connection with the work.

- 1.6 FEES, PERMITS AND INSPECTIONS: This Contractor shall secure and pay all fees, permits and inspections required on work performed under this section of the contract Specifications. Fees shall include, but not limited to, sewer, water and/or gas taps and all gas/ water meter fees charged by the utility companies. He shall assume full responsibility for all assessments and taxes necessary for completion and acceptance of this work.
- 1.7 APPLICABLE CODES AND STANDARDS: All materials, arrangements, and workmanship shall comply with all applicable codes, specifications, federal and state laws, local ordinances, industry standards and utility company regulations. In case of difference between building codes, Specifications, Federal and State laws, local ordinances, standards and utility company regulations and the Contract Documents, the most stringent requirement shall govern. The Contractor shall promptly notify the Architect in writing of such difference. Should the Contractor perform any work that does not comply with requirements of the applicable building codes, Federal and State laws, local ordinances, industry standards, and utility company regulations, he shall bear all costs arising in correcting the deficiencies. Applicable Codes and Standards shall include all state laws, State Board Health and State Rating Bureau, local ordinances, industry standards, and utility company regulations. Comply with applicable requirements of the following national accepted codes and standards as though they were copied herein fully:

ARI	Air Conditioning and Refrigeration Institute
ADC	Air Diffusion Council
AMCA	Air Moving & Control Association
AABC	American Air Balance Council
AGA	American Gas Association
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning Engineers - Handbook
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society of Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
CISPI	Cast-Iron Soil Pipe Institute
CTI	Cooling Tower Institute
FM	Factory Mutual System
HI	Hydronic Institute
IBC	International Building Code
IEEE	Institute of Electrical and Electronic Engineers
IPC	International Plumbing Code
MSS	Manufacturer's Standardization Society
MPTA	Mechanical Power Transmission Association
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturers Association
NEBB	National Environmental Balancing Bureau
NFPA	National Fire Protection Association - Fire Codes
NSF	National Sanitation Foundation

OSHA	Occupational Safety and Health Act Standards
PDI	Plumbing and Drainage Institute
SMACNA	Sheet Metal & Air Conditioning Contractors National Association
SAE	Society of Automotive Engineers
UL	Underwriters' Laboratories

1.8 APPROVAL OF MATERIALS AND EQUIPMENT:

- A. Quality Standards: Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard of quality and shall not be construed as limiting competition. Any material, article or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Architect's written approval. In order that all bidders, manufacturers, and vendors receive fair and equal consideration, the procedures described hereinafter shall be complied with.
- B. Approval of Substitutions: Prior written approval by the Architect/Engineer is required for substitutions for all materials, articles and equipment specified without qualifications or followed by "or prior approved equal". Request for prior approval shall be submitted to the Architect, with copy to Engineer, at least ten (10) days before time of bid opening. Approved substitutions will be included in an addendum to the Specification or in writing at the discretion of the Architect. Request for approval for materials, articles, and equipment qualified with "equal to" or "or equal" shall be submitted within 30 days after award of contract but before purchase. IN CONNECTION WITH THE USE OF ANY ALTERNATE ITEM APPROVED BY THE ARCHITECT, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO SEE THAT SUCH ITEMS MEET ALL REQUIREMENTS, AND THAT ANY ALTERATIONS TO CONNECTING OR ASSOCIATED ITEMS NECESSITATED BY USE OF THE ALTERNATE ITEMS ARE PROPERLY MADE WITHOUT ADDITIONAL COSTS TO THE OWNER. This includes but is not limited to added breakers, fuses, disconnects, wiring, or piping that is not indicated by scheduled equipment. Architect's opinion shall be final on quality of substituted items.
- C. Manufacturer's Brochures and Shop Drawings: As soon as practicable after award of the contract and before starting installation of any materials or equipment, the Contractor shall submit to the Architect for approval six (6) copies of Manufacturer's brochures and shop Drawings giving rating, operating characteristics, wiring diagrams, power requirements, etc., of the material and equipment proposed for installation. A complete electrical connection diagram for each electrically controlled component shall be submitted for approval. The connection diagram shall identify each component and shall show all interconnected and interlocked components. Automatic temperature control diagrams shall be submitted. All data submitted shall be sufficiently complete to demonstrate conformance with the Specification requirements. Drawings showing all ducts, piping and installation details shall be submitted for approval with Material and Equipment submittal if equipment is different from that indicated on the Drawings. Checking and approval of brochures and shop Drawings by the Architect shall not relieve the Contractor from the responsibility for deviations from the Drawings and Specifications unless he has in writing called the Architect's attention to such deviations at time of submission and secured his written approval, nor shall it relieve him of responsibility for errors or omissions in the shop Drawings. Checking and approval by

the Architect is only for general conformance with design intent and contract requirements. It is the Contractor's responsibility to verify the accuracy of dimensions, obtaining field dimensions, by comparison and measurements in the field. Final shop Drawings shall indicate field verified dimensions.

1.9 DEVIATIONS:

- A. Drawings: The Mechanical Drawings show the general arrangement of all piping, equipment, and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The mechanical work shall conform to the requirements shown on all of the Drawings. General and Structural Drawings shall take precedence over Mechanical Drawings. Because of the small scale of the Mechanical Drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, valves and accessories as maybe required to meet such conditions. If major departures from the contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable for approval. No major departures shall be made without prior written approval.
- B. Space Conditions: Every attempt has been made to design the systems so as to cover the installation of all equipment and connections thereto without interference to the structural design of the building. Contractor shall note that space in some locations is critical, and shall prior to installing his work coordinate the location with all other trades. If interference results from failure of the Contractor to exercise such caution, work shall be relocated as the Engineer ascertains would most facilitate job progress. Relocation shall be at the expense of the Contractor whose work is relocated, and the decision of the Engineer shall be final. If Contractor is unable to achieve desired cooperation with other trades and/or subcontractors, he is cautioned not to proceed but to inform the Engineer as to his difficulties. Contractor shall make offsets, transitions and changes in direction in pipe, ducts, etc., as required to maintain proper grades, or essential elevations.

1.10 COOPERATION: Cooperate and coordinate with others in laying out work so that this phase of the work will properly fit the building and other contractors' requirements. Priority of locations shall be as follows:

- Light Fixtures
- Ceiling Mounted Air Control Devices
- Fire Protection System
- Ductwork
- Plumbing Waste, Drain and Vent System
- Mechanical Equipment
- Electrical Equipment
- Mechanical Piping Mains
- Electrical Feeders

1.11 OPERATING AND MAINTENANCE INSTRUCTIONS:

- A. Bound Instructions: Four (4) complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Owner. Each set shall be permanently bound and shall have a hard cover. One complete set shall be furnished at the time the test procedure is submitted, and the remaining sets shall be furnished before the Contract is completed. Flysheet shall be

placed before instructions covering each subject. Flysheet shall be placed before instructions covering each subject. The instructions sheets shall approximately 8-1/2" by 11" with large sheets of Drawings folded in. The instructions shall include, but shall not be limited to the following:

1. System layout showing piping, valves, and controls.
 2. Approved wiring and control diagrams, with data to explain the detailed operation and control of each component.
 3. A control sequence describing startup, operation and shutdown.
 4. Operating and maintenance instructions for each piece of equipment, including lubrication instructions.
 5. Manufacturer's bulletins, cuts and descriptive data.
 6. Parts lists and recommended spare parts.
- B. Framed Instructions: Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping, valves and control sequence, framed under glass or in approved laminated plastic, shall be posted where directed. In addition, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in type form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. Proposed diagrams, instructions and other sheets shall be submitted for approval prior to posting.
- C. Field Instructions: Upon completion of the work and at a time designated, the services of one project engineer shall be provided by the Contractor to instruct the representative of the Owner in the operation and maintenance of the mechanical systems.
- D. Temporary Equipment: Mechanical Contractor shall not run HVAC equipment during duration of project when dust from construction is present. When space is properly cleaned, the Engineer will inspect space conditions and approve the use of HVAC equipment. If temporary heating/cooling is necessary for construction of project, Mechanical Contractor will need to notify other trades that it will not be provided by them.

1.12 RECORD DRAWINGS:

- A. This Contractor shall provide record Drawings at completion of job. Drawings to show all significant changes in piping, equipment, wiring, etc. The actual location of all piping drains, clean-outs, apparatus and equipment shall be indicated. These Drawings are to be turned over to the Architect at completion. All cleanouts and concealed equipment (below grade) to be dimensioned from building lines, etc.

1.13 CONNECTION OF EQUIPMENT FIXTURES FURNISHED BY OTHERS:

- A. This Contractor shall provide all necessary materials and labor to connect to the mechanical systems all equipment and fixtures having mechanical connection and which are specified in other Divisions of the project Specifications. Drainage connections shall be trapped. The supply and return lines for each item of equipment or fixture, except control valves with integral stops, shall be provided with cut-off valves to enable isolation of the item for repair and maintenance without interfering with the operation of other equipment or fixtures. Refer to other Divisions of the project Specifications for additional requirements. Actual rough-in dimensions shall be obtained from shop Drawings or

measurements of the equipment or fixture.

- B. The unpacking, assembling and setting of equipment furnished by the Owner or under other than Mechanical Sections of these Specifications will not be performed under this Division of the Specifications.
- C. Due to the fact that the manufacture of the equipment actually purchased may vary slightly from that specified in the above lists and therefore require some rearranging of equipment different from that indicated on the Drawings, the Contractor shall make connections to such rearranged equipment without additional cost to the Owner. That is, for an initial installation arrangement other than that indicated on the Drawings. Equipment will be furnished complete with faucets, waste strainer and tailpiece. This Contractor shall supply traps, supplies, and stops for above equipment.

1.14 ELECTRICAL:

- A. Refer to the Electrical Drawings and Division 16, ELECTRICAL WORK, for the characteristic of the available electrical power. All motors and equipment under this contract to be compatible with the local voltages.
- B. For each and every motor installed under this section of the contract, furnish to the Electrical Contractor for installation the proper motor starter, where not specified to be furnished by the electrical contractor and where required, pushbuttons or hand-off automatic controls, or other required relays or control devices. All motors which start and stop automatically or as specified, shall be furnished with magnetic starters, pushbuttons and relays as required. The Electrical Contractor will wire from service to starter to motor. Any additional secondary control circuits, such as remote control stations, and temperature control wiring shall be provided under this Division. Each and every wire in each and every junction box, starter, pull box or where else terminating or connecting or visible shall be color coded and numbered using Brady Stick-On numbers or equivalent. Upon completion of all wiring, including control and secondary wiring, Contractor shall furnish finished shop Drawing showing each wire number and connecting points for each and every unit. Contractor shall 'meg' every circuit to determine leaks or shorts and correct same before calling for inspection by Engineer.
- C. All wiring installed under the responsibility of this Contractor shall be in conduit and in strict accordance with the National Electrical Code and DIVISION 16, ELECTRICAL WORK of the project Specifications.

1.15 WORKMANSHIP:

- A. All work shall be executed in a neat and substantial manner by skilled workmen well qualified and regularly engaged in the type of work required. Substandard work shall be removed and replaced by the Contractor at no cost to the Owner.

1.16 CLEANING AND PAINTING:

- A. The respective Contractors or Sub-contractors for the various phases of the work shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished under any or all Contracts in a clean first class condition.
- B. All plumbing fixtures shall be thoroughly cleaned of all plaster, stickers, rust stains and other foreign matter or discoloration, leaving every part in an acceptable condition and ready for use. The surfaces of all pumps, motors, floor drains, cleanouts and other equipment shall be cleaned and each item shall be left in a first class condition.

- C. Painting of materials and equipment furnished under the mechanical portion of the Contract is specified under the General Construction Contract as described in other Sections. The Mechanical Contractor shall, however, refinish and restore to the original conditions and appearance, all mechanical equipment which has sustained damage to manufacturer's prime and finish coats of enamel or paint. Materials and workmanship shall be equal to the requirements described for other painting.
- 1.17 DELIVERY AND STORAGE: Equipment and materials shall be handled, stored, and protected to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Architect/Engineer. Damaged or defective items shall be replaced.
- 1.18 STANDARD PRODUCTS/SERVICE AVAILABILITY:
- A. Materials and Equipment: Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year use shall include applications of equipment and materials under similar circumstances and of similar size.
 - B. Experience Required: The two-year experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures.
 - C. Service Support: The equipment items shall be supported by service organizations. The Contractor shall submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
 - D. Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.
- 1.19 EXISTING UTILITIES, STRUCTURES AND OTHER PROPERTY: Prior to any excavation, it shall be the responsibility of the Contractor to locate and avoid damage to any and all existing water, gas, sewer, electric, telephone and all other underground utilities or structures. The Contractor shall contact the various local utility departments or other responsible agencies and obtain location Drawings, or other assistance in the locations of existing underground work. The Contractor shall repair or pay for all damage caused by his operations to all existing property, public or private, whether it is below or above ground, and shall settle in total cost all damage suits which may arise as a result of his operations.
- 1.20 GUARANTEE: This Contractor shall guarantee to Owner, all work performed under this contract to be free from defects in workmanship and materials for a period of one year from date of final acceptance by Architect and Owner. Any defects arising during this period will be promptly remedied by the Contractor without cost to the Owner. Compressors shall have a five (5) year warranty.

PART 2 - NOT APPLICABLE

PART 3 - NOT APPLICABLE

END OF SECTION

SECTION 23 07 00
INSULATION OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Piping Insulation, Jackets, and Accessories.
- B. Equipment Insulation and Covering.
- C. Ductwork Insulation, Jackets and Lining.

1.3 QUALITY ASSURANCE:

- A. Applicator: A company specializing in insulation application with three years minimum experience.

1.4 SUBMITTALS:

- A. Submit product data under the provisions Section 23 01 00.
- B. Include product description, list of materials and thickness for each service, equipment and location.
- C. Submit manufacturer's installation instructions.

1.5 MANUFACTURER'S STAMP OR LABEL:

- A. Every package of insulation, jackets, cement, adhesives, and coatings delivered to the project site must have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material.

1.6 FLAME SPREAD AND SMOKE DEVELOPED RATINGS:

- A. In accordance with NFPA 255, ASTM E 84, or UL 723, the materials shall have a flame - spread rating of not more than 25 and a smoke - developed rating of not more than 50.
- B. Materials Tests: UL label or satisfactory certified test report from a testing laboratory will be required to indicate that the fire hazard ratings for the materials proposed for use do not exceed those specified. Test factory-applied materials as assembled. Field-applied materials may be tested individually. Flame-proofing treatments subject to deterioration due to effects of moisture or high humidity are not acceptable.
- C. Materials Exempt From Fire-Resistant Rating: Nylon anchors and PVC fitting covers.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS INSULATION:

- A. Piping systems requiring insulation, types of insulation required, and insulation thickness shall be as listed in Tables I and II herein. Insulate all fittings, flanges, and valves with factory premolded, precut, or field-fabricated insulation of the same thickness and

conductivity as used on adjacent piping. Use factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as used on adjacent piping. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling.

B. Pipe Insulation:

1. Glass Fiber Insulation: ANSI/ASTM C547; 'K' value of .24 at 75 degrees F.; noncombustible.
2. Flexible Unicellular Insulation: ASTM C 534. Adhesive shall be as recommended by the insulation manufacturer and applied in accordance with the manufacturer's published instructions.

C. Pipe Insulation Finishes:

1. All-Purpose Jacket: Provide a factory applied all-purpose jacket with or without integral vapor barrier as required by the service. Provide jackets in exposed locations with a white surface suitable for field painting without sizing. Allow a maximum water vapor permeance of 0.05 perm per ASTM E 96, a puncture resistance of not less than 50 Beach units, and a minimum tensile strength of 35 pounds force per inch of width in accordance with ASTM D 828.
2. Vapor Barrier Materials: Kraft reinforced foil vapor barrier with self-sealing adhesive joints. Resistant to flame, moisture penetration, and mold growth. Provide vapor-barrier materials on pipe as required in Table I.

2.2 DUCTS AND PLENUMS (HVAC) INSULATION:

A. Duct Insulation in Concealed Spaces: Insulation shall be blanket type flexible mineral fiber conforming to ASTM C 553, Type I, Class B-3, 1.0 pounds per cubic foot nominal, and 2.0 inches thick. Flexible insulation shall be used in concealed spaces only.

B. Duct Insulation Finishes:

1. All-Purpose Jacket: Provide a factory applied all-purpose jacket with integral vapor barrier as required by the services. Provide jackets in exposed locations in equipment rooms with a white surface suitable for field painting without sizing.
2. Vapor Barrier Material: Scrim foil facing. Materials shall be resistant to flame, moisture penetration, and shall not support mold growth. Provide vapor barrier on all HVAC duct insulation. All-purpose jacket shall have a maximum water vapor permeance of 0.05 perm per ASTM E 96; a puncture resistance of not less than 50 Beach units; and a tensile strength of not less than 35 pounds-force per inch width in accordance with ASTM D 828.

2.3 EQUIPMENT:

A. Insulate all equipment and accessories as specified in Table III. Increase the specified insulation thickness for equipment only where necessary to equal the thickness of angels or other structural members to make a smooth exterior surface.

2.4 ADHESIVE, SEALANTS, AND COATING COMPOUND:

A. Adhesive for Securing Insulation to Metal Surfaces and Vapor Barrier Lap Adhesive: ASTM C 916, Type I, (and adhesive in which the vehicle is nonflammable in the liquid state and which will pass the burning test).

B. Mineral Fiber Insulation Cement: ASTM C 195, thermal conductivity 0.85 maximum at

200 degrees F. mean when tested per ASTM C 177.

- C. Vapor Barrier Coatings: Manufacturer's recommendation for indoor on surface temperature of 60 degrees and above, color white.
- D. Flexible Unicellular Insulation Adhesive: Compatible with the Insulation.
- E. Finishing Cement: ASTM C 449.

2.5 ACCESSORIES:

- A. Staples: ASTM A 167, Type 304 or 316 stainless steel, outside-clinch type.
- B. Insulation Bands: 3/4-inch wide: 0.20-inch aluminum.
- C. Glass Cloth and Tape: Tape shall be 4-inch wide rolls, shall be 405 ounces per square yard. Open weave glass membrane may be used in lieu of glass cloth.
- D. Wire: Soft annealed stainless steel, 0.047-inch nominal diameter.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Do not insulate materials until all system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Insulate return ducts, outside air intakes and supply ducts to the room outlets, exhaust ducts, flexible run outs, plenums, casings, mixing boxes, filter boxes, coils, fans, and the portion of air terminals not in the conditioned spaces. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handle, safety relief, etc. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during the application of any finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:
 - 1. Factory pre-insulated flexible ductwork.
 - 2. Factory insulated ductwork, plenums, casing, mixing boxes, and filter boxes.
 - 3. Vertical portion of interior roof drain pipelines, chrome plated pipes, and fire protection pipes.
 - 4. Vibration isolating connections.
 - 5. Adjacent insulation.
 - 6. ASME stamps.
 - 7. Equipment name plates.
 - 8. Access plates in fan housing.

3.2 PIPING INSULATION:

- A. General: Insulation shall be continuous through sleeves, wall and ceiling openings. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation. Provide a moisture and vapor seal where insulation terminates against metal hangers,

anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Bevel and seal the edges of exposed insulation.

- B. Glass Fiber Insulation: Place sections of glass fiber pipe insulation around the pipe and joints tightly butted into place. Secure jacket with fire resistant adhesive or factory applied self-sealing lap. Cover circumferential joints with butt strips, not less than 3-inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches. When a vapor barrier jacket is required, as indicated in TABLE I, or on the ends of section of insulation that butt against flanges, unions, valves, and fittings, and joints, use a vapor-barrier coating. Apply this vapor barrier coating at all longitudinal and circumferential laps. At penetrations by pressure gauges and thermometers, fill the voids with the vapor barrier coating. Seal with a brush coat of the same coating.
- C. Flexible Unicellular Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Apply two coats of vinyl lacquer finish to flexible unicellular insulation in outside locations.
- D. Hangers and Anchors: Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide MSS SP-58, Type 40 galvanized steel shields or MSS SP-58, Type 39 protection saddles conforming to MSS SP-69. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Vapor seal insulation around anchors. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same thickness as adjacent insulation. Inserts shall have sufficient compressive strength to support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe
- E. Sleeves: Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2-inches beyond the interior surface of the wall.
- F. Flanges, Unions, Valves and Fittings Insulation for Hot Piping: Factory fabricated removable and reusable insulation covers may be used. For domestic hot water, heating hot water; exposed hot water piping and drains in handicap areas, place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. Elbows insulated using segments shall have not less than three segments per elbow. Place and joint the segments with manufacturer's recommended water vapor resistant, fire retardant, and adhesive appropriate for the temperature limit of the service. Factory pre-mold one-piece PVC fitting covers may be used in lieu of two coats of adhesive with tape embedded between coats. Factory premolded field-fabricated segment or blanket insert insulation shall be used under the fitting covers. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks

made for securing PVC fitting covers.

- G. Flanges, Unions, Valves, Anchors, Fittings for Cold Piping: Factory-fabricated removable and reusable insulation covers may be used. For piping insulation, domestic cold water, chilled water supply and return, refrigerant suction, and exposed lavatory drains, coat pipe insulation ends with vapor barrier coating not more than six inches from each flange, union, valve, anchor or fitting. Place insulation of the same thickness and conductivity as the adjoining pipe insulation (either premolded or segmented) around the item, butting the adjoining pipe insulation. Elbows insulated using segments shall not have less than 3 segments per elbow. Apply two coats of vapor barrier coating with glass tape embedded between coats. Overlap tape seams one inch. Extend the coating out onto the adjoining pipe insulation 2 inches. Seal the insulation and jacket with two coats of vapor barrier coating with glass tape embedded between coats. Insulate anchors attached directly to the pipe for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface. At the option of the Contractor, premolded, one-piece polyvinyl chloride (PVC) fitting covers may be used in lieu of the embedded glass tape. Factory premolded insulation or field-fabricated insulation segments shall be used under the fitting covers. Secure the covers with adhesive and vapor barrier tape, or with tacks made for securing PVC covers. Then coat all tape seams and tacks with vapor barrier coating.

<u>SERVICE</u>	<u>MATERIAL</u>	<u>SPECIFICATION</u>	<u>TYPE</u>	<u>CLASS</u>	<u>VAPOR BARRIER REQUIRED</u>
Refrigerant Suction	Flexible Unicellular	ASTM C 547	I or II	1	No
Domestic Hot Water Domestic Cold Water	Mineral Fiber	ASTM C 547		1	No
	Mineral Fiber	ASTM C 547		1	Yes
A/C Condensate Drain	Flexible Unicellular	ASTM C 534	I or II		No
Exposed Domestic Hot Water Piping & Drains to Areas for Handicapped Personnel	Flexible Unicellular	ASTM C 534	I or II		No

TABLE 2
INSULATION SIZES FOR PIPING

<u>SERVICE</u>	<u>MATERIAL</u>	<u>1/4" - 1-1/4"</u>	<u>1-1/2" - 3"</u>	<u>4" - UP</u>
Refrigerant Suction	Flexible Unicellular	3/4"	3/4"	3/4"
Domestic Hot Water	Mineral Fiber	1"	1"	1-1/2"

Domestic Cold Water	Mineral Fiber	1/2"	1/2"	1/2"
A/C Condensate Drain	Flexible Unicellular	1/2"	1/2"	1/2"
Exposed Domestic Hot Water Piping & Drains to Areas for Handicapped Personnel	Flexible Unicellular	1/2"	1/2"	1/2"

END OF SECTION

SECTION 23 09 00
CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Complete system of automatic controls.
- B. Instrumentation.

1.3 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.
- B. Shop drawings shall indicate operating data, system diagrams, wiring diagrams, interlock diagram indicating inter-connection for all motor starters, description of operating sequences, and sizing of components.
- C. Provide product data for each manufactured component.
- D. Include list of instruments which indicates use, range, and location.

PART 2 – PRODUCTS

2.1 Instrumentation and Control Devices

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: The control system shall be installed, tested, and adjusted by competent mechanics under the supervision of the contractor for the work specified to be furnished under Division 15.
- B. Electrical Work: All power wiring is specified to be furnished under Division 16, Electrical Work of these specifications. Furnish the contractor for the electrical work, equipment electrical requirements and other data pertaining to the electrical phases of the mechanical installation. All control wiring of the mechanical systems shall be accomplished under this Division. Control and interlock wiring shall be fully color coded, numbered using Brady Stick-On numbers, in conduit, and shall comply with all the requirements of Division 16, Electrical Work.
- C. Coordination: Any changes in the required controls as a result of equipment substitution under this division shall be the responsibility of the contractor for this division and shall be accomplished at no additional cost to the owner.

3.2 SEQUENCE OF OPERATION:

- A. Mini Splits: Provide for remote hand held thermostats for each unit to permit setting the unit and removing thermostat to a safe position. Units shall allow for auto changeover, fan mode, vane actuation, heat, cool, and dry modes. Units shall be as provided by

manufacturer with 3 hours training for the Owner.

- B. Exhaust Fan: Toilet exhaust fan will be interlocked to lights with occupancy sensor for operation.

END OF SECTION

SECTION 23 20 00
HEATING AND AIR CONDITIONING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Refrigerant Piping
- B. Drain, Vent, and Overflow Piping.

1.3 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.
- B. Submit certification of pipe conformance to Specification.
- C. Submit well installers qualifications.

1.4 Quality Assurance

- A. Welders' Certification: In conformance with AWS D1.1.
- B. For each product, provide components by same manufacturer throughout.

PART 2 - PRODUCTS

2.1 BASIC MATERIALS:

- A. Refer to Section 22 05 00, BASIC MATERIALS AND METHODS, for basic piping materials.
- B. General: All piping in conjunction with the heating and air conditioning system shall be complete as indicated on the drawings or as required for the proper operation of the system.

2.2 REFRIGERANT PIPING:

- A. Hard Drawn:
 - 1. Tubing: Type ACR hard drawn conforming to ASTM B 280.
 - 2. Fittings: Wrought copper fittings conforming to ANSI B16.22.
 - 3. Joints: Silver brazed joints conforming to ANSI A5.8.
- B. Soft Drawn (Accepted Up To 3ft Maximum Length):
 - 1. Tubing: Type K copper tubing conforming to ASTM B88
 - 2. Fittings/Joints: Flared tube end with compression type fittings conforming to ASME/ANSI B16.26.
- C. Sight Glass: A combination moisture and liquid indicator, double port type, UL listed. The indicator shall have a glass port for complete view of the refrigerant flow and

moisture sensitive indicator of the type that changes color. Sight glass shall be equal to Sporlan "See-All".

- D. Driers: Permanent type liquid line dehydrator with inlet and outlet shut-off valves. Driers shall be equal to Sporlan "Catch-All".
 - E. Expansion Valves: The valves shall be of the stainless steel diaphragm type with external equalization and external super-heat adjustment set for 10°F super-heat.
 - F. Shut-Off-Valves: Manual valves shall be for refrigeration service with back seating construction and cap seals. Valves shall be Mueller Brass or approved equal.
- 2.3 DRAIN, VENT, AND OVERFLOW PIPING: Materials: Schedule 40 PVC or copper tubing, Type L, conforming to ASTM B 88 with cast-brass or wrought-copper sweat joint fittings. Drains at air handling units shall be provided with water seals, depth equal to the total static pressure of the blower, constructed of two tees and an appropriate U-bend with open end of each tee plugged. Pipe and equipment drains with valves shall provide complete draining of all systems. Pipe to nearest open-sight drain, floor drain, wet vent, or as indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Piping shall comply with the general piping installation specified in Section 22 05 00, Basic Materials and Methods.
- B. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- C. Dry refrigerant systems per manufacturers direction. Purge all systems with inert gas similar to nitrogen prior to pulling vacuum and charging system.

END OF SECTION

SECTION 23 30 00
AIR DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Section 23 01 00 - Mechanical General Requirements, with modifications and additions specified herein, apply to the work specified in this Section.

1.2 SECTION INCLUDES:

- A. Ductwork and Ductwork Accessories.
- B. Grilles and Registers
- C. Louvers & Block Vents.

1.3 SUBMITTALS:

- A. Submit product data and shop drawings under provisions of Section 23 01 00.

1.4 REGULATORY REQUIREMENTS:

- A. Construct Ductwork to recommendations in SMACNA Duct Construction Manual, and to the requirements of NFPA 90A.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

- A. Sheet Steel for Ducts: ASTM A 525 and ASTM A 527 galvanized sheet steel, lock-forming quality, having zinc coating of 1.25 oz. per sq. ft. for each side in conformance with ASTM A 90.
- B. Galvanized Steel Hot Dipped After Fabrication: ASTM A 123.
- C. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

2.2 AIR LOUVERS AND BLOCK VENTS:

- A. Outside air stationary air louvers to be rain resistant, extruded aluminum construction, fixed drainable blade type as manufactured by Ruskin, Greenheck, or approved equal. Louvers to be constructed of minimum 0.081" thick frame and blades. Louver depth to be 5" with equal blade spacing. Blade construction to provide built-in rain stops. Provide 1/2" mesh expanded aluminum screen with removable frame mounted on inside face of louver. Design basis shall be Ruskin Model ELF-375X for rectangular louver. All air louvers shall be provided by DIV 15. Reference mechanical and architectural drawings. Color as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Installation shall conform to NFPA and SMACNA. Provide mounting and supporting of ductwork and accessories including, but not limited to, structural supports, hangers, vibration isolators, stands, clamps and brackets, access doors and dampers.

Install ductwork accessories as indicated in accordance with the manufacturer's printed instruction. Allow clearance for inspection, repair, replacement, and service.

- B. Ductwork: Install airtight. When air distribution systems are operated, there shall be no chatter, vibration, or dust marks.
- C. Duct Supports: Ducts shall be supported by not less than two 1-inch wide by 1/16-inch thick galvanized strap of sheet steel hangers located one on each side of duct, spaced not over 5-feet on centers for round ducts and not over 6-feet on centers for ducts up to 24-inches wide and not over 3-1/2-feet on centers for ducts over 24-inches wide. Support flexible ducts every 3 feet. Provide sway bracing. Anchor risers in the vertical run to allow ends of riser free vertical movement. Attach supports only to structural framing members and concrete slabs. Provide suitable metal intermediate framing where supports are required between structural framing members. Do not support ducts from metal decking.

END OF SECTION