SECTION 22 01 00

GENERAL PLUMBING PROVISIONS

PART 1 GENERAL

1.1 WORK INCLUDED

A. The work covered by Division 22 sections consist of furnishing all labor, equipment, appliances and material for the heating, air conditioning, piping and plumbing systems in strict accordance with Codes, Specifications and the applicable drawings and subject to the terms and conditions of the contract. Include all appurtenances necessary to the proper operation of the systems and equipment specified.

B. Construction Manager shall install all concrete pads and bases required for installing mechanical equipment. Mechanical Contractor is responsible for the exact sizes required, location of anchor bolts, etc.

C. Some equipment may be furnished by other divisions. Mechanical Contractor is responsible to check the drawings and specifications for equipment that will be furnished by others. Furnish the supplies (hot and cold water cut-offs), traps, drains, controls, gas piping, backflow preventers, pressure reducing valves, etc., on all equipment furnished by other divisions.

D. Construction Manager shall furnish and install all ceiling access panels required to service mechanical equipment, valves and controls above gyp board or hidden spline ceilings.

E. Construction Manager shall provide all site drive, sidewalk and other surfaced areas saw cutting and repairs back to preexisting conditions for the required mechanical piping. Mechanical Contractor shall provide the trenching, bedding and backfill required for the pipe installation.

1.2 RELATED SECTIONS

A. The General Conditions and Division 1, General Requirements, as bound in the specification preamble, apply to all work under Division 22. Carefully note its contents in performance of the work.

B. The Architectural, Mechanical, Electrical and Structural plans and Specifications, including Information to Bidders and other pertinent documents issued by the Engineer are a part of this Specifications and the accompanying mechanical plans. Comply with them in every respect. Examine all the above carefully. Failure to comply does not relieve the Contractor of responsibility nor may it be used as a basis for additional compensation due to omission of architectural, electrical and structural details from the mechanical drawings.

C. All electrical power wiring is specified under Division 26 of the Specifications. Mechanical Contractor shall furnish all motor starters required for the control and protection of all motors furnished for the Division 22.

D. All concrete pads and bases required for installing mechanical equipment are specified in another section of the Specifications. Advise the Construction Manager as to the exact sizes required, location of anchor bolts, etc.

E. Paint all mechanical equipment, piping, supports and other exposed material. Do not paint indoor equipment supplied with painted finish, such as the main mechanical equipment unless damaged during handling and installation. In such cases, use touch-up paint of the same type and color as original paint. Conform to requirements in other sections of the Specifications and match wall finish to the room in which installed.

1.3 CODES, FEES AND LATERAL COSTS

A. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations, and the applicable requirements of the following latest nationally accepted codes and standards:

1. Myrtle Beach, South Carolina City Building Code; latest accepted edition.
2. South Carolina State Mechanical Code; latest accepted edition.
3. South Carolina State Plumbing Code; latest accepted edition.
4. South Caolina Energy Code; latest accepted edition.
5. IBC - International Building Code; latest accepted edition.
6. IFC - International Fire Code; latest accepted edition.
7. IGC - International Gas Code; latest accepted edition.
8. IPC - International Plumbing Code; latest accepted edition.
9. IMC - International Mechanical Code; latest accepted edition.
10. IECC - International Energy Conservation Code; latest accepted edition.
11. AMCA - Air Moving & Conditioning Association.
12. ASA - American Standards Association.
13. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
14. ASME - American Society of Mechanical Engineers.
15. ASTM - American Society of Testing Materials.
16. AWWA - American Water Works Association.
17. NBS - National Bureau of Standards.
18. NEMA - National Electrical Manufacturers Association.

19. NFPA - National Fire Protection Association.

20. SMACNA - Sheet Metal & Air Conditioning Contractors' National Association.

21. UL - Underwriters' Laboratories, Inc.

22. AGA - American Gas Association.

23. OSHA - Occupational Safety and Hazard Association.

24. AABC - Associated Air Balance Councils.

25. NEBB - National Environmental Balancing Bureau.

B. Comply with State of South Carolina adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

C. In case of difference between building codes, Specifications, state Laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent governs. Promptly notify the Engineer in writing of any such difference.

D. Remove any work installed that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, correct the deficiencies, and reinstall all work at no cost to the Owner.

E. The mechanical drawings show the general arrangement of all piping, equipment and appurtenances. Follow as closely as actual building construction and the work of other trades will permit. Final layout will be governed by actual field conditions with all measurements verified at the site. Conform to the requirements shown on all of the drawings. General and structural drawings 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. Investigate the existing and finish conditions affecting the work and arrange the work accordingly, providing such fittings, valves and accessories as may be required to meet such conditions. Contractor shall verify that all equipment, ducts, pipes and all other components will fit in the space provided before fabrication or ordering.

F. Obtain any and all required permits in connection with this work under the Contract and pay any and all fees in connection therewith. Arrange with the serving utility companies for the connections to all utilities and pay all charges for same including inspection fees and meters if required. Refundable deposits will be paid by the Owner.

G. Mechanical Contractor shall provide and install, where applicable, seismic restraints for all piping and duct systems per the latest accepted Building Code.

1.4 GUARANTEE

A. Furnish a written certificate guaranteeing all materials, equipment and labor furnished to be free of all defects for a period of one (1) year from and after the date of final acceptance of the

work by the Owner and further guarantee to replace such work without charges if any defects appear within the stipulated guaranty period.

1.5 SOIL CONDITIONS

A. The Specifications and the drawings in no way imply the conditions of the soil to be encountered. When excavating may be required in execution of the work, this Contractor agrees that he has informed himself regarding conditions affecting the work.

1.6 INSPECTION OF PREMISES

A. Before submitting a bid, visit the site of the proposed job and determine the conditions relating to this work.

1.7 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered as a general guide only, without guarantee as to accuracy. Verify the location and elevation of all utilities and their relation to the work before entering into a contract.

B. Identify outdoor underground lines with continuous strip of plastic utility marker tape at regular intervals (maximum of 10 feet) "Caution (state utility) pipe below". Install one foot directly above pipe before backfilling to grade.

1.8 EXISTING BUILDING AND EXISTING MECHANICAL EQUIPMENT

A. Visit the existing building and become thoroughly acquainted with the existing physical plant, mechanical systems and utilities in order to determine all of the work that will be necessary to carry out the intent of the plans and specifications.

B. If it is necessary, in any way, to interfere with normal operations of the existing utilities in order to carry out the work, give notice and obtain written approval from the Owner before the work is started.

C. The work involved in this project requires the Contractor to work inside of an existing building. Interruption of the regular routine of the building by the Contractor must be kept to a minimum.

1.9 EQUIPMENT NOT SPECIFIED UNDER DIVISION 22

A. Equipment which requires plumbing and other mechanical connections may be specified in another division of this Specification. Under these conditions, provide necessary utilities including waste, water and natural gas.

B. Rough-in work from approved shop drawings only.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 COORDINATION OF WORK

A. Compare the mechanical drawings and Specifications with the drawings and Specifications for other trades and report any discrepancies between them to the Engineer and obtain from him written instruction for changes necessary in the mechanical work. Install the mechanical work in cooperation with other trades installing inter-related work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. Make all changes required in the work caused either by neglect or existing field conditions at no cost to the Owner.

B. It is the responsibility of the Construction Manager, Mechanical Contractor, Electrical Contractor and Sprinkler Contractor to coordinate installation of all equipment. Equipment installed prior to proper coordination, which interferes with the harmony and intent of the specifications and drawings, will be removed and reinstalled at the cost of the responsible Contractor.

C. Furnish anchor bolts, sleeves, inserts and supports required for the mechanical work. Locate anchor bolts, sleeves, inserts and supports as directed by the trade requiring them and insure that they are properly installed.

D. Adjust locations of pipes, ducts, equipment fixtures, etc., to accommodate the work and for interferences anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

1. Provide right-of-way to lines that pitch over those that do not pitch. For example, Plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have the right-of-way over lines whose elevations can be changed.

2. Make offsets, transitions and changes in direction in pipes and ducts as required to maintain proper head room and pitch.

E. Install all mechanical work to permit removal without damage to other parts, to coils, fan shafts and wheels, filters, belt guards, sheaves and drives and all other parts requiring periodic replacement or maintenance. Arrange pipes, ducts and equipment to permit ready access to valves, cocks, traps, starters, motors, control components and to clear the openings of swinging and overhead doors and of access panels.

3.2 CHLORINATION OF DOMESTIC WATER LINES

A. After the hot and cold water systems are complete, all fixtures connected, the system flushed out completely and the shut-off valve to the water main closed, fill the system with a solution containing 50 parts per million of available chlorine. Allow the solution to stand six (6) hours before flushing and returning to service.

B. Then fill the system with a solution containing 100 parts per million of available chlorine. Allow this solution to stand two (2) hours before flushing and returning to service.

C. Notify the Owner twenty-four hours prior to test so his representative can witness test. Obtain chemical analysis of the domestic water lines after chlorination from a Certified Chemist and submit the results of these tests to the Engineer and Owner.

3.3 RECORD DRAWINGS

A. Maintain record drawings showing exact locations and sizes, as actually installed, of piping, drains, cleanouts, ductwork, controls and equipment as specified herein. Deliver to the Owner/Architect upon completion and acceptance of the work, one (1) complete set of contract drawings marked to indicate all deviations from intended installation.

3.4 CUTTING AND PATCHING

A. The Construction Manager shall be responsible for all required cutting, patching, etc., incidental to this work and shall make all required repairs thereafter to the satisfaction of the Engineer. Do not cut into any major structural element, beam or column without the written approval of the Engineer.

B. Cut, patch, repair and/or replace pavements, sidewalks, roads and curbs as required to permit the installation of the work and pay all expenses incurred for this work.

C. Openings in fire or smoke barriers for air handling ductwork or air movement shall be protected in accordance with NFPA 90A and 90B and the Standard Mechanical Code.

D. Pipes, conduits, cables, wires, air ducts, pneumatic tubes and ducts and similar handling service equipment that pass through fire or smoke barriers shall be protected in accordance with NFPA 101.

E. All fire stopping assemblies must be UL approved assemblies.

3.5 EXCAVATION AND TRENCHING FOR PIPING

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

B. Trench Excavation: Grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil. Where rock is encountered excavate to a minimum overdepth of 4" below trench depths indicated on the Drawings or specified. Overdepth in rock excavation and unauthorized overdepths shall be backfilled. Whenever wet or otherwise

unstable soil incapable of properly supporting the pipe is encountered such soil shall be removed and the trench backfilled to proper grade as hereinafter specified.

C. Depth of Cover: Trenches shall be of depth that will provide three feet (3') minimum cover for domestic water, fire lines, sanitary and storm sewers from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

D. Utilities Locating: Locate existing utility lines prior to beginning any excavation

E. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor, at his expense.

F. Trenches shall not be backfilled until required pressure and other tests have been performed and until the utilities systems as installed conform to requirements of Drawings and Specifications.

G. Backfill trenches with excavated materials consisting of earth, sandy clay, sand, gravel, soft shale or other approved materials, free from clods of earth or stones 2-1/2" maximum dimension, deposited in 6" layers and compacted to 95% Standard Proctor Compaction Test of the maximum laboratory density determined in accordance with ASTM D698, Moisture-Density Relation of Soils. If fills fail to meet the specified densities, the Contractor shall remove and re-compact the fill until specified densities are achieved. Compaction test shall be performed for each fifty linear feet of trench.

H. Provide a 4-inch thick (minimum) layer of 3/4-inch No. 4 gravel aggregate bedding beneath all buried piping. Bedding shall be compacted and leveled to provide sloping required.

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

3.6 EQUIPMENT START-UP AND TESTING

A. Instruct the Owner's operating personnel during start-up and separate operating tests of each major item of equipment. During the operating tests, prove the operation of each item of equipment to the satisfaction of the Engineer. Give at least seven (7) days notice to the Engineer of equipment start-up and operating tests.

3.7 CATALOG DATA FOR OWNER

A. Provide, in looseleaf binders, two (2) sets of a compilation of catalog data of each manufactured item of equipment used in the mechanical work and present this compilation to the Owner/Architect for transmittal to the Owner before final payment is made. Include

descriptive data and printed installation, operating and maintenance instructions for each item of equipment. Provide a complete double index as follows:

1. Listing of products alphabetically by name.

2. Listing the names of manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the names and addresses of the local sales representatives.

3. Certificates of Final Inspections.

4. Complete spare parts data with current prices and supply sources.

5. Extended warranties.

B. Deliver to the Owner all special tools, lubricants, extra materials and any other products necessary for the proper operation and maintenance of the mechanical and plumbing systems.

C. Provide project record documents indicating all changes from contract documents made during construction.

D. Submit all Certificates of Final Inspections from the Administrative Authorities.

E. Submit TAB reports on approved forms. Final TAB report submittals shall include all required rebalances if any are required.

3.8 INSTRUCTION OF OWNER'S REPRESENTATIVE

A. Instruct the representative of the Owner in the proper operation and maintenance of all elements of the mechanical system.

3.9 PROTECTIVE COATINGS

A. Paint exterior surfaces of steel piping run in or through concrete floor fill, under tile floors or underground, and aluminum surfaces in contact with masonry, with one coat of acid resisting bituminous base paint.

3.10 TEST AND ACCEPTANCE

A. Water Piping System: Test with air at 100 psi for one (1) hour or with available city water pressure for twenty-four (24) hours to prove tight and free from leaks.

B. Plumbing and Drainage System: Test the new system humidity and drain piping with water and prove tight. Test system with 10 feet of water for 24 hour period. Air test is not permitted.

3.11 NOISE CONTROL

A. It is intended that the mechanical systems as installed under this contract be free from objectionable noise when the system is operating. The system shall operate at noise levels below criteria recommended for the application by ASHRAE. Provide vibration isolation

accessories and isolate equipment, pipeline, ductwork, etc., as required so as to insure an acceptable noise level in all of the mechanical systems.

3.12 CLEANING AND ADJUSTING

A. Do not allow waste material and rubbish to accumulate in or above the premises. After completion of this work, remove rubbish, tools, scaffolding and surplus materials from and about the building and leave all work clean and ready for use. Clean all equipment, pipes, valves and fittings of grease, metal cuttings and sludge. Repair any stoppage, discoloration or other damage to parts of the building, its finish or furnishings due to failure to properly clean the mechanical systems, without additional cost to the Owner. Adjust all automatic control devices for proper operation.

3.13 SYSTEM OPERATING TESTS

A. After the successful completion of all equipment start-up and test requirements, perform the following tests on the complete mechanical systems:

1. First Operating Test by Contractor: Prove the operation of the mechanical systems and of each individual item in the systems. Give at least 10 days prior notice to the Engineer of such tests. Adjust and set proper quantities to all items and equipment. Should any item of the systems fail to perform in an approved manner, repeat this test until approved by the Engineer. During this test, balance circulation of heating and cooling water to balancing cocks, valves, thermostats and similar Items to insure that the mechanical systems perform as intended.

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

3. Contractor's Corrections to Systems: Make all required corrections to the systems and notify the Engineer in wiring that the corrections outlined have been completed. Give at least seven (7) days notice of a final three-day operating test.

4. Three-Day Operating Test: Perform an operating test to the satisfaction of the Engineer for a period of three (3) days. Should any element of the systems not perform properly, make all required corrections and repeat the test until successfully performed.

a. Submit the Form of Record proposed by the Contractor for the recording of all measurements to the Engineer for approval at least two weeks before the approved form will be required by the Contractor.

b. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the three-day operating test.

1. Electrical: Running amperes and voltage of each motor 3/4 horsepower or larger.

2. Air temperatures in each heated or air conditioned space and outdoor temperatures.

c. Instruments: Provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms as approved by the Engineer. Submit for the Engineer's approval, complete shop drawings or catalog data for all instruments to be used for the three day operating test and obtain approval at least two weeks before the instruments will be required for test measurements.

d. Report: Submit four (4) copies of a written report of the three-day operating test on the approved Form of Record to the Engineer for approval and subsequent transmittal to the Owner.

3.14 MOTOR CONTROL

A. General: Provide each motor 1/8 horsepower or larger with a suitable controller and devices that will perform the functions as specified for the respective motors, together with manual reset thermal overload, protection in each undergrounded conductor. Provide the controller either integral with circuit protective device or mounted in separate enclosure. Starters shall be Allen-Bradley, G.E., Westinghouse, Square D or approved equal.

B. Control: Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motor directly, provided the device used is designated for that purpose and has an adequate horsepower rating. When automatic control device does not have such a rating, use a magnetic starter with the automatic control device actuating the pilot control circuit. When combination manual and automatic control is specified and the control device operates the motor directly, provide a manual motor starter and selector switch. When combination manual and automatic control is specified and the automatic control device actuates the pilot control circuit, a magnetic control device actuates the pilot control provided. Provide all magnetic starters with push buttons or selector switches in the covers. Provide connections to the selector switch such that only the normal automatic regulating control devices will be bypassed when the switch is in the manual position. Connect all safety control devices, such as low or high pressure cutouts, high temperature cutouts and motor overload protective devices in the motor control circuit in both the manual and automatic positions of the selector switch control circuit. Make connections to any selector switch or to more than one (1) automatic regulatory control device in accordance with wiring diagrams recommended by the manufacturer and approved by the Engineer. Where required for manual control, provide push-button stations consisting of two (2) momentary contact operators, 600 volts, 10 amperes installed and wired for three wire control to provide under-voltage relays, auxiliary contacts or other devices required for a complete system.

C. Location: Where the controller is located within sight of the motor driven equipment (fifty feet or less), the controller and circuit protective device shall be capable of being locked in the open position. Where the controller is located out of sight of the motor driven equipment (more than fifty feet) provide a non-fused safety disconnect, suitable for the service, and which opens all ungrounded conductors simultaneously, at or on the motor driven equipment.

D. Enclosure: Enclosure to be general purpose, NEMA Type 1 unless noted otherwise (NEMA Type 1 gasketed). The circuit breaker shall be operable by hand from outside the enclosure and shall be so interlocked with the door or doors that it must be returned to the "OFF" position before the door can be opened.

E. Push-buttons: Provide maintained contact, standard duty type in a general purpose, NEMA Type 1 enclosure for surface mounting rated for 10 amperes continuous at 600 volts or less.

3.15 ACCESS PANELS

A. Provide access panels as required in all walls, ceilings and ductwork to service and have access to all valves, and other operating parts. For all ceiling and wall access doors that are required in gypsum board and plaster, provide minimum 24" x 24", Milcor type appropriate for the construction involved. Contractor shall provide all access doors as required to provide adequate access.

3.16 FINALLY

A. It is the intention that this specification shall provide a complete installation except as herein before specifically excepted. All accessory construction and apparatus necessary or advantageous in the operation and testing of the work shall be included. The omission of specific reference to any part of the work necessary for such complete installation shall not be interpreted as relieving this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.

1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Equipment support bases.

D. Vibration isolators.

E. Seismic snubber assemblies.

F. Seismic restraints for suspended components and equipment.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 21 05 48 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 DEFINITIONS

A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g. piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.4 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2011.

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).

J. MFMA-4 - Metal Framing Standards Publication; 2004.

K. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Seismic Controls:

a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.

b. Coordinate the work with other trades to accommodate relative positioning of essential and non-essential components in consideration of seismic interaction.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. All seismic / wind / vibration/seismic restraint systems shall be by a single manufacturer.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification method for spring element load capacities.

2. Seismic Controls: Include seismic load capacities.

E. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

F. Shop Drawings - Seismic Controls:

1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.

2. Identify mounting conditions required for equipment seismic qualification.

3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.

4. Indicate proposed arrangement of distributed system trapeze support groupings.

5. Indicate proposed locations for distributed system flexible fittings and/or connections.

6. Indicate locations of seismic separations where applicable.

G. Seismic Design Data:

1. Compile information on project-specific characteristics of actual installed plumbing components necessary for determining seismic design forces required to design appropriate seismic controls.

a. Component operating weight and center of gravity.

b. Component elevation in the building in relation to the roof elevation (z/h).

c. Component importance factor (Ip).

d. For distributed systems, component materials and connection methods.

e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.

f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).

2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Manufacturer’s detailed field testing and inspection procedures.

K. Field quality control test reports.

L. Shop Drawings:

1. Provide schedule of vibration isolator type with location and load on each.

2. Fully dimensioned fabrication drawings and installation details for vibration isolation bases, member sizes, attachments to isolators, and supported equipment.

3. Include the seal of the Professional Engineer registered in the State of South Carolina in which the Project is located, on drawings and calculations which at a minimum include the following:

a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.

b. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.

c. Detailed description of the equipment anchorage devices on which the certifications are based.

1.7 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in South Carolina and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

E. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.

2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

4. Select vibration isolators for outdoor equipment to comply with wind design requirements.

5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2 inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation: As indicated on drawings.

E. Piping Isolation:

1. Minimum Static Deflection:

    a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.

    b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.

2. Suspended Piping, Non-Seismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.

3. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.

4. Floor-Mounted Piping, Non-Seismic Applications: Use open (unhoused) spring isolators.

5. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.

6. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g. walls, floors) arranged to prevent vibration transmission to structure.

2.2 SEISMIC CONTROL REQUIREMENTS

A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.

B. Seismic Design Criteria: As indicated on drawings.

C. Component Importance Factor (Ip): Plumbing components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.

D. Seismic Restraints:

1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.

2. Seismic Restraint Exemptions:

    a. Exemptions for Seismic Design Category C:

        1. Plumbing components with component importance factor (Ip) of 1.0.

2. Plumbing piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch or less; exemption does not apply to piping constructed of low-deformability materials (e.g. cast iron, glass, nonductile plastics).

b. Exemptions for Seismic Design Category D, E, and F:

1. Plumbing components with component importance factor (Ip) of 1.0 where all of the following apply:

(a) The component is positively attached to the structure.

(b) Flexible connections are provided between the component and associated ductwork, piping, and conduit.

(c) Either:

(1) The component weighs 400 pounds or less and has a center of mass located 4 feet or less above the adjacent floor level.

(2) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.

2. Plumbing piping with component importance factor (Ip) of 1.0 and nominal pipe size of 3 inch or less, or with component importance factor (Ip) of 1.5 and nominal pipe size of 1 inch or less; exemption does not apply to piping constructed of low-deformability materials (e.g. cast iron, glass, nonductile plastics).

c. Plumbing Piping Exemptions, All Seismic Design Categories:

1. Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet requirements for exemption as single pipes described under specific seismic design category exemptions above.

2. Hanger supported piping where each hanger in the piping run is 12 inches or less in length from the pipe support to the supporting structure; rod hangers, where used, to be equipped with swivels.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:

a. ASHRAE (HVACA).

b. FEMA 412.

c. FEMA 413.

d. FEMA 414.

e. FEMA E-74.

f. SMACNA (SRM).

4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third party registered professional engineer acceptable to authorities having jurisdiction.

5. Seismic Type Vibration Isolators:

   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

6. External Seismic Snubber Assemblies:

   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).

   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.

7. Seismic Restraint Systems:

   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.

   b. Use only cable restraints to restrain vibration-isolated plumbing components, including distributed systems.

   c. Use only one restraint system type for a given plumbing component or distributed system (e.g. piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.

   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.

   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported plumbing component weight.

   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.

   g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.

h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.

i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

E. Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.

2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.

3. Do not use power-actuated fasteners.

4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.

6. Concrete Housekeeping Pads:

a. Increase size of pad as required to comply with anchor requirements.

b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

F. Seismic Interactions:

1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.

2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

G. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:

a. Relative displacements at connections between components, including distributed systems (e.g. piping); do not exceed load limits for equipment utility connections.

b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.

c. Design displacements at seismic separations.

d. Anticipated drifts between floors.

2.3 MANUFACTURERS

A. Kinetics Noise Control, Inc; _____: www.kineticsnoise.com/#sle.

B. Mason Industries; _____: www.mason-ind.com/#sle.

C. Substitutions: See Section 22 01 00.

2.4 EQUIPMENT SUPPORT BASES

A. Vibration-Isolated Structural Steel Bases:

1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

B. Vibration-Isolated Concrete Inertia Bases:

1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

2. Minimum Base Depth: 6 inches.

3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.

4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.

5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

2.5 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

2. Spring Elements for Spring Isolators:

a. Color code or otherwise identify springs to indicate load capacity.

b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.

c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.

d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.

e. Selected to provide designed deflection of not less than 75 percent of specified deflection.

f. Selected to function without undue stress or overloading.

3. Seismic Snubbing Elements for Seismic Isolators:

a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.

b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

B. Vibration Isolators for Non-Seismic Applications:

1. Resilient Material Isolator Pads:

a. Description: Single or multiple layer pads utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material.

b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.

c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

2. Resilient Material Isolator Mounts, Non-Seismic:

a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material; fail-safe type.

3. Open (Unhoused) Spring Isolators:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.

b. Bottom Load Plate: Non-skid molded elastomeric isolator material or steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.

c. Furnished with integral leveling device for positioning and securing supported equipment.

4. Housed Spring Isolators:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.

b. Furnished with integral elastomeric snubbing elements, non-adjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.

c. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.

d. Furnished with integral leveling device for positioning and securing supported equipment.

5. Restrained Spring Isolators, Non-Seismic:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.

b. Bottom Load Plate: Steel with non-skid elastomeric isolator pad with provisions for bolting to supporting structure as required.

c. Furnished with integral leveling device for positioning and securing supported equipment.

d. Provides constant free and operating height.

6. Resilient Material Isolator Hangers, Non-Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.

7. Spring Isolator Hangers, Non-Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

8. Combination Resilient Material/Spring Isolator Hangers, Non-Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

C. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:

a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g. neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.

2. Restrained Spring Isolators, Seismic:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g. neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.

b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.

c. Furnished with integral leveling device for positioning and securing supported equipment.

d. Provides constant free and operating height.

3. Resilient Material Isolator Hangers, Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g. neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

4. Spring Isolator Hangers, Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

5. Combination Resilient Material/Spring Isolator Hangers, Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g. neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short circuiting of isolation.

2.6 SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:

1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.

2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.7 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:

1. Comply with ASCE 19.

2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.

3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.

4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 CODE-REQUIRED SPECIAL INSPECTIONS

A. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

B. Seismic special inspections include, but are not limited to:

1. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.

2. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved contract documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.

C. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.3 INSTALLATION

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

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Spring Isolators:

a. Position equipment at operating height; provide temporary blocking as required.

b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.

c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.

2. Isolator Hangers:

a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.

b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.

3. Clean debris from beneath vibration-isolated equipment that could cause short circuiting of isolation.

4. Use elastomeric grommets for attachments where required to prevent short circuiting of isolation.

5. Adjust isolators to be free of isolation short circuits during normal operation.

6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

F. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.

2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.

3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.

4. Equipment with Sheet Metal Housings:

a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.

b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.

c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

5. Concrete Housekeeping Pads:

a. Size in accordance with seismic design to meet anchor requirements.

b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

6. Seismic Restraint Systems:

a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.

b. Install restraints within permissible angles in accordance with seismic design.

c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.

d. Install cable restraints for vibration-isolated components slightly slack to prevent short circuiting of isolation.

e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.4 FIELD QUALITY CONTROL

A. Inspect vibration isolation and/or seismic control components for damage and defects.

B. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to perform inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.

C. Vibration Isolation Systems:

1. Verify isolator static deflections.

2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:

1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

F. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

E. Ceiling tacks.

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

C. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number. Valve locations with tag numbers shall also be indicated on "as-built" drawings.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

2.2 IDENTIFICATION APPLICATIONS

A. Instrumentation: Tags.

B. Piping: Pipe markers.

C. Pumps: Nameplates.

D. Small-sized Equipment: Tags.

E. Tanks: Nameplates.

F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.3 NAMEPLATES

A. Manufacturers:

1. Kolbi Pipe Marker Co.

2. Seton Identification Products.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2. Letter Height: 1/4 inch.

3. Background Color: Black.

4. Plastic: Conform to ASTM D709.

2.4 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving.

2. Brady Corporation.

3. Kolbi Pipe Marker Co.

4. Seton Identification Products.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame. Valve tag chart should should indicate valve size, valve model and valve location. Valve locations with tag numbers shall also be indicated on "as-built" drawings.

2.5 STENCILS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. Seton Identification Products.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.

2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

C. Stencil Paint: Semi-gloss enamel, colors conforming to ASME A13.1.

2.6 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation.

2. Kolbi Pipe Marker Co.

3. MIFAB, Inc.

4. Seton Identification Products.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

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

F. Color code as follows:

1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

2. Fire Quenching Fluids: Red with white letters.

3. Combustible Fluids: Brown with white letters.

2.7 CEILING TACKS

A. Manufacturers:

1. Marking Services Incorporated.

2. Seton.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Color code as follows:

1. Plumbing Equipment: Yellow.

2. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Apply ASME A13.1 Pipe Marking Rules:

1. Place pipe marker adjacent to changes in direction.

2. Place pipe marker adjacent each valve port and flange end.

3. Place pipe marker at both sides of floor and wall penetrations.

4. Place pipe marker every 25 to 50 feet interval of straight run.

G. Install metallic detection tape located approximately 12 inches above pipe, where in ground utility lines are buried outside building footprint. Tape shall be continuous and be marked, indicating utility type (ie. water, sewer, gas, electric, etc).

H. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Locate ceiling tacks to locate valves above lay-in panel ceilings. Locate in corner of panel closest to equipment.

J. Identify all piping on this project as described, except piping which is concealed and/or not accessible. Identify piping concealed by ceiling tiles, floor tiles and, crawl spaces. Piping outside, on roof, above grade, and within parking structures shall also be identified. Only piping located within walls or inaccessible areas need not be identified. Install pipe markers on long straight runs every 20 feet. Install pipe markers above and below every floor penetration and on either side of every wall penetration and, insure there is at least one marker per pipe in every room. Install pipe markers at every valve, branch and, any change in piping direction. Install pipe markers so they are visible for a normal standing position.

END OF SECTION

SECTION 22 07 19

PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Piping insulation.

C. Jackets and accessories.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2024).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2024).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2025.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

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

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

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Deliver material to job site in original non-broken factory packaging, labeled with manufacturer's density and thickness.

1.7 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

C. Perform work at ambient and equipment temperature as recommended by the adhesive manufacturer.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.2 GLASS FIBER

A. Manufacturers:

1. Knauf Insulation.

2. Johns Manville Corporation.

3. Owens Corning Corp.

4. CertainTeed Corporation.

5. Armstrong World Industries, Inc.

6. Rubatex Corp.

7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C547 ; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C177, 0.24 at 75 degrees F.

2. Maximum service temperature: 650 degrees F.

3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:

1. Compatible with insulation.

F. Insulating Cement/Mastic:

1. ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.

2. Blanket: 1.0 lb/cu ft density.

3. Weave: 5x5.

H. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.

2. Vinyl emulsion type acrylic, compatible with insulation, white color.

I. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Outdoor Breather Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement:

1. ASTM C449/C449M.

2.3 CELLULAR GLASS

A. Manufacturers:

1. Pittsburgh Corning Corporation.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C 552.

1. 'K' value: 0.37 at 100 degrees F.

2. Service Temperature: Up to 900 degrees F.

3. Water Vapor Permeability: 0.005 perm inch.

4. Water Absorption: 0.2 percent by volume, maximum.

2.4 HYDROUS CALCIUM SILICATE

A. Manufacturers:

1. Johns Manville Corporation.

2. PABCO.

3. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: ASTM C533 ; rigid molded, asbestos free, gold color.

1. 'K' value: ASTM C177 and C518; 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or C518.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Insulating Cement:

1. ASTM C449/C449M.

2.5 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Armacell International.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534 Grade 2; use molded tubular material wherever possible.

1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.

2. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.

3. Maximum Moisture Absorption - Sheets: 6.0 percent, by weight, when tested in accordance with ASTM D 1056.

4. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

1. Air dried, contact adhesive, compatible with insulation.

2.6 JACKETS

A. PVC Plastic.

1. Manufacturers:

a. Johns Manville Corporation.

b. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.

b. Maximum Service Temperature: 150 degrees F.

c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 15 mil.

e. Connections: Pressure sensitive color matching vinyl tape.

3. Covering Adhesive Mastic:

a. Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.

2. Finish: Embossed.

3. Joining: Longitudinal slip joints and 2 inch laps.

4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

C. Repair all insulation that is damaged during construction using the same materials.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Inserts and Shields:

1. Application: Piping 1 inch diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

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

M. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.3 SCHEDULES

A. Plumbing Systems:

1. Domestic Hot Water Supply:

a. Glass Fiber Insulation:

1. Pipe Size Range: 2 inch and under: 1 inch thickness.

2. Pipe Size Range: 2-1/2 inch and larger: 1-1/2 inch thickness.

3. Thickness: 1/2 inch (in interior walls).

2. Domestic Cold Water Supply:

a. Glass Fiber Insulation:

1. Pipe Size Range: 2 inch and under: 1 inch thickness.

2. Pipe Size Range: 2-1/2 inch and larger: 1 inch thickness.

3. Thickness: 1/2 inch (in interior walls).

3. Domestic Hot Water Recirculation:

a. Glass Fiber Insulation:

1. Pipe Size Range: All sizes.

2. Thickness: 1 inch.

B. Cooling Systems:

1. Condensate Drains from Cooling Coils: 1/2 inch thickness; cellular insulation.

2. Refrigerant Suction: 3/4 inch thickness; cellular insulation.

3. Refrigerant Hot Gas: 3/4 inch thickness; cellular insulation.

END OF SECTION

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

1. Sanitary sewer.

2. Domestic water.

3. Gas.

4. Flanges, unions, and couplings.

5. Valves.

6. Flow controls.

7. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 22 01 00 - General Plumbing Provisions.

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

C. Section 22 07 19 - Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.

G. ASME B31.9 - Building Services Piping; 2025.

H. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2025, with Errata.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2025.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2025.

L. ASTM B32 - Standard Specification for Solder Metal; 2020.

M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2025.

N. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2025.

O. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

P. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile; 2004 (Reapproved 2014).

Q. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2020 (Reapproved 2025).

R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

S. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; latest accepted edition.

T. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).

U. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.

V. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

W. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2024.

X. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

Y. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

Z. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe; 2024.

AA. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

BB. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

CC. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

DD. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

EE. AWWA C950 - Fiberglass Pressure Pipe; 2020.

FF. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

GG. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

HH. MSS SP-67 - Butterfly Valves; 2022.

II. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

JJ. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

KK. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

LL. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

MM. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Perform Work in accordance with South Carolina, city of Myrtle Beach, South Carolina standards.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Welding Materials and Procedures: Conform to ASME (BPV IX) .

E. Welder Qualifications: Certified in accordance with ASME (BPV IX).

F. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of South Carolina, and city of Myrtle Beach plumbing code.

B. Conform to city of Myrtle Beach, South Carolina code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.8 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Pipe sizes 4 inches or less: Solvent welded, with ASTM D 2564 solvent cement.

3. Joints: Pipe sizes greater than 4 inch: Push-on, using ASTM F477 elastomeric gaskets.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.

2. Joints: Pipe sizes 4 inch and smaller: Solvent welded, with ASTM D 2564 solvent cement.

3. Joints: Pipe sizes greater than 4 inch: Push-on, using ASTM F477 elastomeric gaskets.

2.3 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C 564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. PVC Pipe: ASTM D2665.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D2564 solvent cement.

D. In Fire-rated Walls:

1. Cast iron.

    a. Fittings: Cast iron.

E. In Plenum-rated Areas:

1. Cast iron.

    a. Fittings: Cast iron.

2.4 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2. Joints: AWWA C111/A21.11, rubber gasket with 3/4 inch diameter rods.

B. Copper Pipe: ASTM B42, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B 32, alloy Sn95 solder.

C. PVC SDR 21: pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.5 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn Type "K".

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

2.6 WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder or mechanical press-fit couplings.

2.7 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, forged steel welding type.

3. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.8 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.

2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.9 MECHANICALLY FORMED TEE FITTINGS

A. Mechanically extracted outlets shall have a height not less than three times the thickness of the branch tube wall.

B. Branch tubes shall not restrict the flow in the main tube. Mechanical Contractor shall insure the branch tube penetration into the collar is of the correct depth.

C. Mechanically formed tee fittings shall be cleaned and brazed with filler material conforming to AWS A5.8.

2.10 PRESS FITTINGS

A. Fittings shall comply with NSF 61, CSA, UPC and be approved by the local jurisdiction. Wrot copper press fittings shall be made from commercially pure copper mill products per ASTM B 75 Alloy C12200. Cast copper alloy press fittings shall be made from materials with

a minimum of 78% copper and a maximum of 15% zinc. The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material, and the fittings shall be manufactured with an inboard bead design. All fittings shall be installed in accordance with the manufacturer's installation instructions and according to local plumbing and mechanical codes. The press-to-connect joint shall be made with pressing tools and jaw sets recommended and authorized by press fitting manufacturer.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.

3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.

2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, split ring.

3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.

5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.

6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.

8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.

10. Vertical Support: Steel riser clamp.

11. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

13. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.12 GATE VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Crane Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up To and Including 2 1/2 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

C. 3 Inches and Larger:

1. MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, handwheel, solid wedge disc, flanged ends. Provide chain wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.13 GLOBE VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Crane Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up To and Including 2 1/2 Inches:

1. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder or threaded ends.

C. 3 Inches and Larger:

1. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Provide chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.14 BALL VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Crane Co.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

2.15 PLUG VALVES

A. Manufacturers:

1. Conbraco Industries.

2. Nibco, Inc.

3. Milwaukee Valve Company.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction 2-1/2 Inches and Larger: MSS SP-78, 250 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.16 BUTTERFLY VALVES

A. Manufacturers:

1. Hammond Valve.
2. Crane Co.
3. Milwaukee Valve Company.
4. Stockham.
5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, elastomer coated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 6 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.17 FLOW CONTROLS

A. Manufacturers:

1. ITT Bell & Gossett.
2. Griswold Controls.
3. Taco, Inc.
4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet , blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi psi.

2.18 SWING CHECK VALVES

A. Manufacturers:

1. Hammond Valve.
2. Nibco, Inc.
3. Milwaukee Valve Company.
4. Crane Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up to 2 Inches:

1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.

C. Over 2 Inches:

1. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.19 SPRING LOADED CHECK VALVES

A. Manufacturers:

1. Hammond Valve.

2. Crane Co.

3. Milwaukee Valve Company.

4. Stockham.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.20 WATER PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc.

2. Cla-Val Co.

3. Watts Regulator Company.

4. Spence Engineering Co.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Up to 2 Inches:

1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:

1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.21 RELIEF VALVES

A. Pressure Relief:

1. Manufacturers:

a. Cla-Val Co.

b. Henry Technologies.

c. Watts Regulator Company.

d. Spence Engineering Co.

e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

B. Temperature and Pressure Relief:

1. Manufacturers:

a. Cla-Val Co.

b. Henry Technologies.

c. Watts Regulator Company.

d. Spence Engineering Co.

e. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

2.22 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc.

2. Green Country Filtration.

3. WEAMCO.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Size 1-1/2 inch to 4 inch:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

C. Size 5 inch and Larger:

1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

I. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted.

P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

Q. Install water piping to ASME B31.9.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. Sleeve pipes passing through partitions, walls and floors.

T. Inserts:

1. Provide inserts for placement in concrete formwork.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

5. 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.

U. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Support horizontal piping as scheduled.

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

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

5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

8. Provide copper plated hangers and supports for copper piping.

9. Provide hangers adjacent to motor driven equipment with vibration isolation.

10. Support cast iron drainage piping at every joint.

V. Where water pressure within the building exceeds 75 psi static, install an approved water-pressure reducing valve conforming to ASSE 1003 with strainer to reduce the building pressure to 75 psi static or less.

3.4 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide ball valves in natural gas systems for shut-off service.

I. Provide flow controls in water recirculating systems where indicated.

J. All sanitary waste and vent pipe installed above grade in fire-rated walls, fire-rated plenum spaces or return air plenums shall be cast iron.

3.5 TOLERANCES

A. Drainage Piping: Maintain invert elevations within 1/4 inch vertically of location indicated on drawings. Slope to drain at minimum of 1/4 inch per foot slope for pipes 3 inch and smaller and 1/8 inch per foot slope for pipes larger than 3 inch.

B. Contractor must maintain inverts as indicated on the drawings. The contractor shall employ the latest precision technology available to insure the accuracy of the installation. If the contractor is unable to maintain, the contractor should notify the engineer IMMEDIATELY to obtain direction.

C. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with South Carolina state and local codes.

B. Prior to starting work, verify system is complete, flushed and clean.

C. 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).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

C. Connection of dissimilar pipe materials shall be made with the specified adapter couplings.

D. Sewers shall be encased or cradled in concrete where shown on the plans or as directed by the Engineer. Unless otherwise noted on the plans, concrete encasement shall encircle the pipe and shall be a minimum thickness of four inches.

E. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 5 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

F. This Contractor shall extend the system of gas piping, to the various outlets as indicated on plans, complete with stop ball valves, drip pockets, valves and other accessories that may be required to give proper and adequate service.

G. Provide gas ball valves in final connection to all equipment. Unions will not be permitted, except in final connections to equipment. Proper reducing fittings shall be used. Bushings will not be accepted. Gas piping in building shall be standard weight schedule 40 black steel pipe with malleable fittings, unless contractor wishes to weld all joints. Welded rod shall be of same material as piping. No. 22 bronze welding will be permitted.

H. All underground gas service exterior to the building (5 psi or less) shall be a polyethylene plastic pipe manufactured in accordance with ASTM No. D-2517 or D-2513 and shall be

indicated on the pipe. Gas piping shall be laid at least 36" below grade at all points. Provide a #12 THN copper wire in trench with pipe and leave both ends exposed for future accessibility.

I. All gas piping in ground, including service, shall be checked with a "Holiday" detector to assure that the coating is free of holes, voids, contamination, cracks, etc. This test shall be performed after the completion of joint and finish coating and touch-up. This test shall be conducted in the presence of the Owner's inspector and performed by experienced personnel.

J. For corrosion protection, all underground and exposed exterior steel pipe and fittings must be coated and wrapped.

K. Test all gas piping operating at 6 oz. with air pump and mercury gauge to pressure that will maintain 25 psig for 20 minutes and inspected by gas service official.

L. All gas piping operating at more than 1 psig shall be tested at 100 psig for steel and 50 psig for plastic, for a minimum of 15 minutes and inspected by gas service official.

M. The pressure regulator at the building shall be sized, and approved by gas service official.

N. All above ground piping shall be rigid steel pipe designated for natural gas use. Pipe shall be painted with a rust inhibiting primer and a final coat the color of which shall be determined by governing regulations or as directed by the Engineer if no governing regulations exist regarding finish color.

O. All gas piping systems within a building and other above ground gas piping shall be electrically continuous and bonded to a grounded electrode as defined in NFPA 70.

P. Medium and high pressure gas regulators installed in the medium and high pressure gas lines (2 psi or greater) shall comply with the following provisions:

1. Shall be suitable for the inlet and outlet gas pressure.

2. Shall comply with Code and gas official requirements.

3. Shall be accessible for servicing.

4. Shall be vented to outdoors when located indoors.

5. Shall be installed in the gas piping system so that it cannot be concealed by building construction.

Q. Provide a listed shut off valve immediately ahead of and immediately behind each medium pressure regulator.

R. Underground gas piping shall be installed in a separate ditch.

3.8 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
    a. Pipe size: 1/2 inches to 1-1/4 inches:
        1. Maximum hanger spacing: 8 ft.
        2. Hanger rod diameter: 1/4 inch.
    b. Pipe size: 1-1/2 inches to 2 inches:
        1. Maximum hanger spacing: 8 ft.
        2. Hanger rod diameter: 1/4 inch.
    c. Pipe size: 2-1/2 inches to 3 inches:
        1. Maximum hanger spacing: 8 ft.
        2. Hanger rod diameter: 3/8 inch.
    d. Pipe size: 4 inches to 6 inches:
        1. Maximum hanger spacing: 8 ft.
        2. Hanger rod diameter: 3/8 inch.
    e. Pipe size: 8 inches to 12 inches:
        1. Maximum hanger spacing: 10 ft.
        2. Hanger rod diameter: 1/2 inch.
    f. Pipe size: 14 inches and Over:
        1. Maximum hanger spacing: 10 ft.
        2. Hanger rod diameter: 7/8 inch..
2. Plastic Piping:
    a. All sizes:
        1. Maximum hanger spacing: 6 ft.
        2. Hanger rod diameter: 3/8 inch.
3. Roof Supports:
    a. Provide gas piping roof supports as indicated on the plans.
    b. Provide condensate piping roof supports as indicated on the plans.

4. Roof Piping Supports:

    a. All sizes:

        1. Maximum linear pipe spacing: 10 ft.

        2. At all changes in direction.

END OF SECTION

SECTION 22 10 06

PLUMBING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof Drains.

B. Floor drains.

C. Floor sink.

D. Cleanouts.

E. Hydrants.

F. Refrigerator valve and recessed box.

G. Backflow preventers.

H. Water hammer arrestors.

I. Mixing valves.

J. Thermostatic mixing valves.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. ASME A112.6.9 - Siphonic Roof Drains; 2005 (Reaffirmed 2019).

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.

C. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.

D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.

E. NSF 372 - Drinking Water System Components - Lead Content; 2024.

F. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Loose Keys for Outside Hose Bibbs: Four.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1 DRAINS

A. Manufacturers:

1. Josam Company.

2. Jay R. Smith Manufacturing Company.

3. Zurn Industries, Inc.

4. Wade Tyler Pipe.

5. MIFAB.

6. J.R. Hoe.

7. Watts

8. Lab Waste.

9. Orion.

10. Substitutions: See Section 22 10 00 - General Plumbing Provisions.

B. Floor Drain:

1. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

C. Floor Sink:

1. Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, removable perforated sediment bucket; and nickel bronze frame; half grate or as indicated on plans.

2.2 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.

2. Josam Company.

3. Ward Manufacturing, Inc.

4. Zurn Industries, Inc.

5. Wade Tyler Pipe.

6. Watts.

7. Lab Waste.

8. Orion.

9. MIFAB.

10. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and heavy-duty, non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round heavy-duty, epoxy coated gasketed tractor-type cover.

D. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas. Coordinate cover with floor finish per architectural plans.

E. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.3 HYDRANTS

A. Manufacturers:

1. Arrowhead Brass Company.

2. Jay R. Smith Manufacturing Company.

3. Zurn Industries, Inc.

4. Wade Tyler Pipe.

5. Woodford.

6. Prier.

7. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Wall Hydrants:

1. ASSE 1019; freeze resistant, self-draining type with chrome plated lockable recessed box hose thread spout, lockshield and removable key, and integral vacuum breaker.

C. Roof Hydrants:

1. Hydrant shall be freeze proof, self draining, Woodford, Model SRH-MS, or equal.

2. Hydrant shall me ASSE 1057

3. The hydrant shall be automatic draindown style and have stainless steel reservoir with no requirement for drainage. Hydrant shall operate on the venturi principle to evacuate the reservoir when operated.

4. Pedestal shall be minimum 24 inches tall and be insulated minimum R-8 thermo-cell insulation.

5. Provide vacuum breaker.

6. Provide under deck mounting frame.

2.4 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Oatey.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Valve Manufacturers:

1. Guy Gray Manufacturing.

2. IPS Corporation/Water-Tite.

3. Zurn Industries, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

C. Description: Painted metal preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.5 BACKFLOW PREVENTERS

A. Manufacturers:

1. Conbraco Industries.

2. Valve Solutions, Inc.

3. Watts Regulator Company.

4. Zurn Industries, Inc.

5. FEBCO.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under

back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.6 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company.

2. Watts Regulator Company.

3. Zurn Industries, Inc.

4. Wade Tyler Pipe.

5. PPP.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.7 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Manufacturers:

a. ESBE.

b. Leonard Valve Company.

c. Honeywell Water Controls.

d. Watts.

e. Powers Process Controls.

f. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

3. Accessories:

a. Check valve on inlets.

b. Volume control shut-off valve on outlet.

c. Stem thermometer on outlet.

d. Strainer stop checks on inlets.

4. Cabinet: 16 gage stainless steel, for surface mounting with keyed lock.

B. Pressure Balanced Mixing Valves:

1. Manufacturers:

a. Delta Faucet Company.

b. H.G. Specialties.

c. Powers Process Controls.

d. Symmons

e. Taconova.

f. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2. Valve: Chrome plated cast brass body, stainless steel cylinder, integral temperature adjustment.

3. Accessories:

a. Volume control shut-off valve on outlet.

b. Stem thermometer on outlet.

c. Strainer stop checks on inlets.

d. Cabinet: 16 gage stainless steel, for surface mounting with keyed lock.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished wall or floor surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade. Refer to plans for detail.

D. Install floor cleanouts at elevation to accommodate finished floor.

1. Provide optional tops to match floor finish. Refer to Architectural plans for floor finishes.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest floor drain or floor sink.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories,sinks, and water closets.

END OF SECTION

SECTION 22 10 08

PLUMBING SOLDER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Lead-free plumbing solder.

1.2 RELATED SECTIONS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

1.3 REFERENCES

A. ASTM B 32 - Standard Specification for Solder Metal; 1996.

B. NSF 61 - Drinking Water System Components - Health Effects; 2002 (ANSI/NSF 61).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Taracorp/IMACO, Inc; 1690 Lowery Street, Winston-Salem, NC 27101-5603. ASD. Tel: (910) 777-8600 or (800) 334-5266, Fax: (800) 637 6697

B. Substitutions: See Section 22 01 00 - General Plumbing Provisions for equipment and material substitutions.

C. Provide all plumbing solder from a single manufacturer.

2.2 MATERIALS

A. Plumbing Solder: Sterling® solder or equal, ASTM B 32, Alloy Grade TC; 95 percent tin, 4.85 percent copper, 0.15 percent selenium.

1. Certified to comply with NSF 61.

2. Melting Temperature: 410 degrees F.

3. Tensile Strength: 7,130 psi.

4. Shear Strength: 5,979 psi.

5. Elongation Percent: 19.1.

6. Brinell Hardness: 15.1.

7. Burst Strength: 5,800 psi.

8. Pressure/Temperature Test Data on Copper Tube Assemblies comprised of 3 inch, 2 inch, 1 inch, 3/4 inch, and 1/2 inch Tubing with a Reducing Tee:

   a. No leaks at 70 degrees F., 200 psi, held for 2 minutes.

   b. No leaks at 180 degrees F., 200 psi, held for 2 minutes.

   c. No leaks at 70 degrees F., 2,000 psi, held for 5 minutes.

B. No lead in plumbing solder.

PART 3 EXECUTION

3.1 INSTALLATION

A. Apply plumbing solder as required by other Sections of these Specifications.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters.

B. Pumps.

1. Circulators.

1.2 RELATED REQUIREMENTS

A. Division 26 - Equipment wiring; electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2019 (Reaffirmed 2024).

1.4 REFERENCE STANDARDS

A. Comply with State of South Carolina adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

B. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2019 (Reaffirmed 2024).

C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

D. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2006.

E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.5 SUBMITTALS

A. See Section 22 01 00 - General Plumbing Provisions, for submittals procedures.

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:

1. Indicate heat exchanger dimensions, size of tappings, and performance data.

2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Standards: 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).

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

1.7 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Pressure Vessels for Heat Exchangers: ASME labeled, to ASME (BPV VIII, 1).

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

1.9 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters.

B. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 WATER HEATER MANUFACTURERS

A. A.O. Smith Water Products Co.

B. Bock Water Heaters, Inc.

C. Rheem Manufacturing Company.

D. Lochinvar.

E. Chronomite Micro.

F. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

2.2 COMMERCIAL GAS FIRED WATER HEATERS

A. Type: Automatic, natural gas-fired, vertical storage.

B. Performance:

1. As specified in drawing schedule.

C. Tank: Glass lined welded steel ASME labelled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

D. Accessories: Brass water connections and dip tube, drain valve, maintenance free powered anode, and ASME rated temperature and pressure relief valve.

1. Water Connections: Brass.

2. Dip tube: Brass.

3. Drain Valve.

4. Anode: Maintenance Free Powered.

5. Temperature and Pressure Relief Valve: ASME labelled.

E. Approval: By AGA as automatic storage water heater

F. Controls: The controls shall be solid state temperature and ignition with integral diagnostics, user interface fault history display and digital temperature readout. Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

2.3 COMMERCIAL ELECTRIC WATER HEATERS

A. Type: Factory-assembled and wired, electric, vertical storage.

B. Performance:

1. As specified in drawing schedule.

C. Electrical Characteristics:

1. As specified in drawing schedule.

D. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

E. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

F. Accessories: Provide:

1. Water connections: Brass.

2. Dip tube.

3. Drain Valve.

4. Anode: Magnesium.

5. Temperature and Pressure Relief Valve: ASME labelled.

2.4 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:

1. Amtrol Inc.

2. ITT Bell & Gossett.

3. Taco, Inc.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

D. Size: Refer to plans or as required to match system volume.

2.5 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.

2. ITT Bell & Gossett.

3. Sterling Fluid Systems.

4. Grundfos.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Casing: Bronze, rated for 150 psig working pressure, with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Performance:

1. As scheduled on drawings.

PART 3 EXECUTION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Install water heaters in accordance with manufacturer's instructions and to AGA or UL requirements.

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

D. Pumps:

1. Provide air cock and drain connection on horizontal pump casings.

2. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

3. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

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

3.2 SCHEDULES

A. Water Heaters:

1. Refer to plan schedule.

B. Recirculating Pumps:

1. Refer to plan schedule.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tank type water closets.

B. Lavatories.

C. Sinks.

D. Service sinks.

E. Electric water coolers.

F. Showers

G. Emergency Eyewash.

1.2 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.

B. Section 22 10 06 - Plumbing Specialties.

C. Section 22 30 00 - Plumbing Equipment.

D. Division 26 - Equipment wiring, electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. Comply with State of South Carolina adopted ADA Accessible Guidelines in regard to accessible or handicapped features.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

E. NSF 61 - Drinking Water System Components - Health Effects; 2024.

F. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.4 SUBMITTALS

A. Section 22 01 00 - General Plumbing Provisions: Procedures for submittals.

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

C. Manufacturer's Instructions: Indicate installation methods and procedures.

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

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. Provide five year manufacturer warranty for electric water cooler.

B. All warranties to begin at Date of Substantial Completion as accepted by the Owner.

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:

1. American Standard Inc.

2. Eljer, Inc.

3. Kohler Company.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Bowl:

1. ASME A112.19.2; floor mounted, pressure assisted siphon jet, vitreous china, 16.5 inches high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps.

2. Water Consumption:

a. Maximum 1.6 gallons per flush.

C. Seat Manufacturers:

1. Bemis Manufacturing Company.

2. Church Seat Company.

3. Olsonite.

2.2 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard Inc.

2. Kohler Company.

3. Zurn.

4. Sloan.

5. Nameeks.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Vitreous China Wall Hung Basin:

1. ASME A112.19.2; vitreous china wall hung lavatory, rectangular basin with rear overflow or less overflow, or front overflow.

a. Drilling Centers: 4 or 8 inch.

2. ADA Compliant.

C. Supply Faucet Manufacturers:

1. American Standard Inc.

2. Zurn industries, Inc.

3. Symmons

4. Chicago Faucets.

5. Delta Faucet Company.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

D. Metered Faucet: ASME A112.18.1; chrome plated metered mixing faucet with low voltage operated solenoid operator and infrared sensor, aerator and cover plate, open grid strainer.

E. Accessories:

1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.

2. Offset waste with plug and strainer where required.

3. Quarter-turn loose key angle stops.

4. Flexible supplies.

5. Carrier:

a. Manufacturers:

1. JOSAM Company.

2. Sloan Valve Company.

3. Zurn Industries, Inc.

4. Watts

5. MIFAB.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.

6. All lavatory faucets shall be listed to ASSE 1070 for temperature and pressure protection with a maximum control flow of 0.5 gpm (2.2 lpm). Faucet shall feature a single cartridge design for ease of repair and maintenance and shall provide an approach temperature of no greater than 5ºF (3°C). Faucet shall include integral check valves to prevent cross flow and shall be in compliance with the American with Disabilities Act (ADA). Faucet shall feature ceramic disc mixing and shall be constructed using Lead Free material.

2.3 SINKS

A. Sink Manufacturers:

1. Elkay.

2. Kohler Company.

3. American Standards.

4. Mac Medical

5. Just.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Single Compartment Bowl:

1. ASME A112.19.3; See schedule for outside dimensions, 18-20 gage thick, Type 304 stainless steel, self-rimming.

2. Drain: Indicated on plans. stainless steel drain.

C. Trim: ASME A112.18.1; chrome plated brass supply with high rise swing spout for multiple bowl sinks and high rise rigid spout for single bowl sinks, water economy aerator with maximum 2.2 gpm flow, indexed lever handles .

1. Acceptable Faucet Manufacturers:

a. Delta Faucet Company.

b. Chicago Faucets.

D. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, quarter turn angle stops with loose key, flexible supplies.

2.4 SURGIICAL SCRUB SINK

A. Manufacturers:

1. Mac Medical

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: Wall Type 304 Stainless Steel, 14 gauge with ground #4 finish, deep sloping basin with adjustable thermostatic controlled pressure regulating mixing valves. High mount swivel gooseneck spout with adjustable swivel spray aerator.

C. Refer to plans for preferred optional features.

2.5 CLINIC SERVICE SINK

A. Manurfacturers:

1. American Standards.

2. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: ASNI/ASME A112.192M, Vitreous china, wall-hung, flushing rim, blow-out operation sink.

C. Flush Volme: 6.5 gpf/24.6 lpf

D. Operating Pressure: 25 psi.

E. Refer to plans for preferred optional features.

2.6 SHOWERS

A. Manufacturers:

1. Symmons.

2. T & S.

3. Bradley.

4. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Type: ASME A12.18.1; Hand held shower system, ADA Compliant shower with pressure balancing valves, intrgrated volume control, 36" slide bar, inline vacuum breaker and 60" flexible hose.

1. GPM. 2.5

2.7 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Tri Palm International/Oasis.

2. Elkay Manufacturing Company.

3. Haws Corporation.

4. Murduck.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Water Cooler: ARI 1010; split level handicapped mounted electric water cooler with stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket, refrigerated with integral air cooled condenser and stainless steel grille.

1. Include bottle filling station. Unit shall include an electronic sensor for touchless activation with auto 20-second shut-off timer. Filler shall provide 1 gpm flow rate with laminar slow to minimize splashing.

C. Capacity: 8 gpm of 50 degree F water with inlet at 80 degree F and room temperature of 90 degree F, when tested in accordance with ASHRAE Std 18.

D. Electrical: Maximum 1/4 hp compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

2.8 SERVICE SINKS

A. Service Sink Manufacturers:

1. Elkay Manufacturing Company.

2. American Standard. Inc..

3. Williams.

4. Crane-Fiat.

5. Florestone.

6. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Bowl:

1. 24 x 24 x 12 inch high white terrazzo, floor mounted, with one inch wide shoulders, vinyl bumper guard, stainless steel wall guards, stainless steel strainer.

C. Trim:

1. ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps, hot and cold water supply check valves, and adjustable threaded wall flanges.

a. Acceptable Faucet Manufacturers:

1. Delta Faucet Company.

2. T&S Brass.

3. Chicago Faucets.

D. Accessories:

1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.

2. Hose clamp hanger.

3. 20 ga. stainless steel splash catcher panels for all adjacent walls.

2.9 EMERGENCY EYE WASH

A. Emergency Wash Manufacturers:

1. Haws Corporation.

2. Guardian.

3. Therm-Omega-Tech, Inc.

4. Bradley.

5. Substitutions: See Section 22 01 00 - General Plumbing Provisions.

B. Construction: ANSI Z358.1-2014, Deck mounted, with backflow preventer, two GS-Plus spray heads, forged brass squeeze valve and 8 reinforced PVC hosed.

2.10 STERILIZERS

A. Construction:

1. Chamber: Type 316L stainless steel.

2. Jacket: Type 304 stainless steel.

3. End Frames: Type 316L stainless steel

B. Pressure: 45 psig, 1.0" sanitary port

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid supplies to fixtures with quarter-turn loose key angle stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, color to match fixture

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

G. Install handicap valve handles to the accessible side.

H. Provide HandiLav or approved equal molded trap and supply insulation kit for all exposed drain and supply handicap lavatories.

I. Install a check valve in the hot and cold water supply at every service sink

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

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

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.8 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.

1. Water Closet:

a. Standard: 15 inches to top of bowl rim.

b. Accessible: 18 inches to top of seat.

2. Water Closet Flush Valves:

a. Standard: 11 inches min. above bowl rim.

3. Urinal:

    a. Standard: 22 inches to top of bowl rim.

    b. Accessible: 17 inches to top of bowl rim.

4. Lavatory:

    a. Standard: 31 inches to top of basin rim.

    b. Accessible: 34 inches maximum to top of basin rim.

5. Drinking Fountain:

    a. Standard Adult: 40 inches to top of basin rim.

    b. Accessible: 36 inches to top of spout.

B. Minimum fixture rough-in sizes or as required for particular fixtures.

1. Water Closet (Flush Valve Type):

    a. Cold Water: 1 Inch.

    b. Waste: 4 Inch.

    c. Vent: 2 Inch.

2. Urinal (Flush Valve Type):

    a. Cold Water: 3/4 Inch.

    b. Waste: 2 Inch.

    c. Vent: 1-1/2 Inch.

3. Lavatory:

    a. Hot Water: 1/2 Inch.

    b. Cold Water: 1/2 Inch.

    c. Waste: 1-1/2 Inch.

    d. Vent: 1-1/4 Inch.

4. Sink:

    a. Hot Water: 1/2 Inch.

    b. Cold Water: 1/2 Inch.

c. Waste: 1-1/2 Inch.

d. Vent: 1-1/4 Inch.

5. Service Sink:

a. Hot Water: 3/4 Inch.

b. Cold Water: 3/4 Inch.

c. Waste: 3 Inch.

d. Vent: 2 Inch.

6. Drinking Fountain:

a. Cold Water: 1/2 Inch.

b. Waste: 1-1/4 Inch.

c. Vent: 1-1/4 Inch.

END OF SECTION

SECTION 22 60 00

GAS AND VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Division pertains to all labor, equipment and services necessary for and incidental to the installation of piped medical gas including oxygen, medical air, nitrogen, instrument air, nitrous oxide, helium, carbon dioxide, argon, dental air, dental vacuum, laboratory air and mixed gas systems as shown on the drawings and/specified herein.

B. Oxygen systems shall be complete to the source valve, ready for connection to the bulk gas supply system.

C. Medical Air systems shall be complete, started, tested and ready for use.

D. Nitrous Oxide, Nitrogen, Carbon Dioxide, Helium, Argon and Mixed Gas Systems shall be complete, tested and ready for use.

E. Bulk Cryogenic (Oxygen, Nitrogen) System. Coordinate all plumbing and alarm connections to the bulk gas source, source start up and system testing, providing owner with system ready for use. (renumber remainder).

F. Medical Vacuum and WAGD systems shall be complete, started, tested and ready for use.

G. Instrument Air systems shall be complete, started, tested and ready for use.

1.2 REFERENCES STANDARDS

A. National Fire Protection Association (NFPA), NFPA 99 Health Care Facilities.

B. National Fire Protection Association (NFPA), NEC National Electrical Code.

C. American Society of Sanitary Engineers (ASSE) 6010 Professional Qualification Standards for Medical Gas System Installers.

D. American Society of Sanitary Engineers (ASSE) 6030 Professional Qualification Standards for Medical Gas System Verifiers.

E. ISO 1217 2009 Displacement Compressors - Acceptance Tests.

F. ISO 13485 Medical Devices - Quality management systems.

1.3 SUBMITTALS

A. Furnish the following as one package:

B. Medical Gas Equipment Manufacturer (MGEM) submittals including at least:

1. A list of certifications currently maintained by the manufacturing facility(ies). Specifically, certificates for ISO 13485 compliance and UL or equivalent shall be included.

2. Complete specifications for the product intended to be installed, dimensional drawings, and wiring schematics where appropriate.

3. For Medical Air and Instrument Air plants include:

    a. Package drawing indicating package style, dimensions when complete, method of disassembly and sizes of subsections for rigging and installation.

    b. Compressor and package capacity expressed in inlet SCFM.

    c. Lubrication method (if any).

    d. Drive detail including adjustment method.

    e. Motor including manufacturer, frame type, service factor, horsepower, current draw, and RPM.

    f. Air filters including type and replacement element.

    g. Pressure regulators including type and manufacturer.

    h. Dew point monitor including technology employed, calibration interval, and annual drift in degrees.

    i. Carbon monoxide monitor including technology employed, calibration interval, and annual drift in ppm.

    j. Air dryers, type; manufacturer; and design dew point at 50 psig.

    k. Sound pressure in dBa when operated at NFPA capacity.

    l. BTU output for the equipment.

    m. PICS sheet for BACnet implementation including vendor code demonstrating the MGEM is also the BACnet vendor.

    n. OSP numbers for all medical air and medical vacuum plant to a minimum Sds of 2.2.

C. For medical gas manifolds include:

1. Third party certification of ISO 10524-2 adiabatic ignition testing.

2. Third party certification of Mil Std 810F environmental testing.

D. For other medical gas products include:

1. Outlet keying system.

2. Alarms networking instructions.

E. Complete installation instructions for the use of the installer.

F. Statement of specific compliance with paragraphs of NFPA 99 most recent edition as relevant to the equipment and as listed in those sections.

G. Complete maintenance schedules.

H. Warranty statement, which must encompass all system components. Warranties covering only specific components or containing exclusions are not acceptable.

I. Name and contact information for local installation assistance, startup, warranty and service. Provide at least one local service contact and a backup service contact physically located within 250 miles of the facility.

J. Description of available Preventative Maintenance programs for Owners review.

K. Information on training programs available to maintenance personnel for Owners review.

L. Medical Gas Verifier Submittals shall include:

1. Name, contact information, MGPHO Credential Number and reference list. Reference list to include not fewer than three references on projects of similar size and complexity.

M. Pre-approval:

1. Preapproved MGEM: Piping Systems Components and Medical Gas Alarms:

a. BeaconMedæs.

b. Ohio Medical.

c. Amico.

2. Written pre-approval is required for equipment not exactly matching specifications or from non-approved MGEM. Submit the information required under Submittals above, attaching a cover letter stating the exact areas of deviation.

3. A request for pre-approval of equipment must be received by the Engineer not less than five (5) business days prior to bid.

1.4 QUALIFICATION OF MANUFACTURER(S)

A. One Medical Gas Equipment Manufacturer (MGEM) shall supply the medical gas, support gas, medical vacuum and WAGD source and pipeline system(s) and equipment to include outlets, valves and gauges, valve boxes, alarm panels, manifolds, medical air, and instrument air, vacuum and WAGD sources.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Divisions 00 and 01, apply to this section.

1.6 OWNER FURNISHED MATERIALS FOR INSTALLATION UNDER THIS SECTION

A. Supply of gases in cylinders or containers as appropriate for manifolds.

B. Initial supply of liquid (oxygen, nitrogen).

1.7 PERFORMANCE REQUIREMENTS

A. All materials used shall be new and of the best grade and quality obtainable and workmanship shall be first class in every respect. Contractor shall be responsible for compliance with all Local, State or Federal codes.

B. Provide all elements and accessories required for complete systems per NFPA 99 most recent edition.

C. Contractor shall make all necessary connections to owner furnished equipment.

D. Install all piping as shown on Drawings, as described herein and as described in Section 15050, Basic Materials and Methods, using methods of fabrication, grading, testing, repairing, cleaning and other procedures as described.

E. Electrical power wiring for vacuum pump(s), medical air compressor(s), WAGD Producer(s), ceiling columns, alarms, and modular accessories associated with the system(s) shall be part of the electrical contract. Any equipment supplied by this contractor that requires additional electrical services shall be the responsibility of this contractor to supply these services.

F. Perform Installer pressure testing, cross connection testing and final testing per NFPA 99 most recent edition and using procedures as specified.

G. Retain a qualified third party verifier acceptable to the engineer and owner to perform and attest to final verification of the systems. Make corrections as required, including additional testing if necessary to attain full and unqualified certification.

1.8 COORDINATION

A. Medical Gas Contractor shall coordinate with other trades to ensure timely installations and avoid conflicts and interference.

B. Work with metal stud partition installer and/or mason to ensure anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.

C. Coordinate with owner to ensure medical gas outlets, whether owner supplied or contractor supplied, in walls, ceiling headwalls, booms, pendants and all other equipment is provided by the same Medical Gas Equipment Manufacturer (MGEM) satisfactory to the owner.

D. Coordinate with bulk cryogenic gas supplier for installation, connection and verification of bulk gas supply systems.

E. Medical Gas Contractor shall supply and install the master alarm system, including the signal wiring. The electrical contractor shall provide power wiring to each alarm panel. Medical Gas Contractor is responsible for proper termination, testing and marking of alarm panels. Termination shall be done by or under supervision of manufacturer of alarm panels.

F. Coordinate with Medical Gas Verifier to deliver a complete, tested medical gas installation ready for owner's use.

PART 2 PRODUCTS

2.1 MATERIALS

A. All pressurized medical gas piping shall be:

1. Seamless ASTM B-819, type K or L hard drawn seamless medical gas copper tubing, identified by the markings "OXY" "MED" "OXY/MED" "OXY/ACR", or "ACR/MED" in green (Type K) or blue (Type L).

2. Fittings shall be wrought copper, brass or bronze designed expressly for brazed connection, compliant with ANSI B16.22.

3. Pipe (Tube), fittings, valves, and other components shall be specially cleaned for oxygen service in a facility equipped to clean, rinse, and purge the material in accordance with the requirements of NFPA 5.1.10.1.1 and received on job site cleaned and capped. On site cleaning of the interior surfaces of tubes, valves, fittings, and other components is not allowed.

4. Brazing alloy shall be BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

B. All vacuum tubing shall be:

1. Type 'L', 'M', or ASTM B-280 ACR copper.

2. Brazed with BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

C. All WAGD piping shall be:

1. Type 'L', 'M', or ASTM B-280 ACR copper, Schedule 5 galvanized steel, or equivalent sized ductwork.

2. If copper, brazed with BCuP-5 Brazing alloy or equivalent alloy with at least 1000 degree F melting point.

D. Isolation of copper tubing from dissimilar metal shall be accomplished either through use of copper or copper plated hangers or hangers with plastic isolators.

2.2 MEDICAL GAS OUTLET STATIONS:

A. Series B:

1. Medical gas outlet stations shall be modular, quick-disconnect recessed type, or DISS screw thread recessed type equal to BeaconMedæs Series B. Threaded DISS connectors shall be per CGA V-5 standard.

2. The rough in assembly shall be of modular design and include a gas specific 16 gauge steel mounting plate designed to permit on-site ganging of multiple outlets, on 5 inch center line spacing. A machined brass outlet block shall be permanently attached to the mounting bracket to permit the 1/2" OD, type-K copper inlet to swivel 360 degrees for attachment to the piping system. The rough in assembly shall contain a double seal to prevent gas leakage between the rough in and latch-valve assemblies after the wall is finished. A single o-ring seal shall not be acceptable.

3. Outlet stations shall have a die cast light gray epoxy powder coated trim plate. Furnish indexed rough in and gas specific latch valve with non-interchangeable safety keying and with color coded gas service identification. The safety keying index pins shall be permanently captured in the latch assembly and non-removable without destroying the outlet. Designs with index pins molded in plastic are not acceptable.

4. The complete outlet shall be made, cleaned and packaged to NFPA 99 Standards, UL Listed and CSA certified. Medical gas outlets shall be cleaned for oxygen service in accordance with CGA Pamphlet G-4.1. The assembly shall be capped and the finish assembly poly bagged for shipment.

5. The latch-valve assembly shall telescope up to 3/4" to allow for variation in finished wall thickness from 1/2" to 1-1/4".

6. Provide outlets conforming to the DISS (threaded) system.

7. Outlets shall be field assembled with sequences and services indicated.

8. DISS Outlets shall be used for all ceiling mount applications.

9. Furnish hose assemblies for all ceiling outlets for the finished ceiling height as indicated on drawings. Provide each hose with a heavy-duty chain type dual retractor for pressure gases and dual for vacuum. Retractors made of stainless cable are not acceptable. Allow an extra 18" of hose length for retractors.

B. Nitrogen (N2) and Instrument Air (IA) Control Panels:

1. Nitrogen and IA control panels shall be designed to deliver variable pressures to power pneumatic surgical tools.

2. The control panel shall be provided with a 0-300 psig pressure gauge, shutoff valve, pressure regulator, delivery pressure gauge and outlet. A quarter turn of the valve handle shall be required to obtain a fully "open" or "closed" position.

3. An adjustable self relieving type pressure regulator, with a operating range of 10 to 250 psi.

4. Control panels shall be pre-piped internally requiring only external supply line connections. Additional outlets in the same room may be connected to the remote outlet pigtail furnished in the control panel. Remote outlets shall be regulated by the adjustable pressure regulator within the panel and shall match the nitrogen control panel outlet.

5. Control panels shall be available in horizontal or vertical orientation.

C. Medical Gas Valves:

1. All Medical Gas Valves shall be specially prepared for oxygen service and shall conform to NFPA 99 5.1.4 and 5.1.10. Valves shall be ball-type, with Teflon seats and adjusting stem packing gland with Teflon stem seal.

2. Valves are three piece construction with swing out center.

3. Valve ends where copper to brass joint is made are forged, complying with 5.1.10.3.1. Cast valves are not acceptable (5.1.10.3.2).

4. Seals between center section and outer flanges are silicone capable of withstanding 500°F (260°C) during the brazing process.

5. Ball valves shall be rated 600 WOG, actuate from full "ON" to full "OFF" by 90 degree turn of vinyl gripped valve handle.

6. Furnish and install only valves with factory installed type K copper tubing extensions.

7. Valves not in valve boxes shall be provided with locking handles, BeaconMedæs series 4255 (locks to be provided by contractor to owner).

8. All valves shall be cleaned for oxygen, capped and sealed in a polyethylene bag for shipping and storage.

9. Valve boxes shall be constructed of 18 gauge steel with white enamel finish. The valve box shall have a sliding, opaque door with pull ring and clear gauge window. The removable window cannot be replaced when any valve is closed. The ABS frame assembly shall be capable of adjusting for variances in wall thickness up to 1". The window shall conceal piping and mounting screws. Window shall be labeled "Caution - Medical Gas Shut - Off Valves - Close Only in Emergency." Provide clear viewing

space in the window to display the gas service, the pressure gauges and the label for areas controlled by the valve.

10. Provide color coded self-adhesive gas labels for compliance with NFPA 99 labeling requirements. Apply labels to each valve in the assembly for gas service identification according to manufactures recommendations.

11. Zone valves shall include a 1 1/2 inch pressure gauge reading 0 to 100 psig for oxygen, air, nitrous oxide and carbon dioxide; 0 to 300 psig for nitrogen and instrument air; and 0 to 30 HG for vacuum and WAGD. The gauge port shall be equipped with removable plug for pressure testing before final assembly of gauge.

12. All zone valve boxes assemblies shall read pressure downstream and vacuum upstream of the valve per NFPA 99. Valves shall be piped left to right with right being on patient side.

13. All main line, riser, service, and futures valves as scheduled on the drawings shall include plugged 1/8" NPTF ports on inlet and outlet.

14. All zone valve assemblies shall have a total of three 1/8" NPT ports with pie plugs. One port to be used as a provision for connection of a gauge and shall be located on the terminal outlet side of the valve to register pipeline pressure or vacuum. The second port to be used as a provision for a DISS connection of a gas sensor. The third port to be used for purging during the brazing process and is located upstream of the valve.

15. All zone valve assembly designs allow for the configuration of up to 7 valves within the rough-in box assembly.

16. All zone valve box assemblies to include Nylon 6/6 insulated grommets to allow for ease of valve replacement and reorientation within the rough-in box.

17. All zone valve box doors to be treated with InstaCure Guardian to reduce/prevent bacterial and mold growth.

D. Medical Gas Alarm Systems:

1. General Requirements:

a. All Medical Gas Alarm panels shall be listed to UL 1069 for Hospital Signaling Equipment as an assembly and shall include factory wiring, transformers, and circuitry requiring only 115 or 230 volt primary power.

b. Alarm panels shall meet the FCC Part 15, Subpart B and ICES-003 to reduce possibility of magnetic radiation interference with other equipment.

c. The alarm shall arrive on the job site pre-configured as shown on the drawings and schedules or shall be configured by MGEM personnel at no additional charge.

d. Alarm shall supervise its wiring to sensors and switches, indicating at the relevant panel(s) if any wire is cut, disconnected or open.

e. Each scheduled signal displays the condition monitored. Activation of any switch will change the display, and actuate the audio alarm.

f. Each panel shall include a power on indicator and test function for testing all modules electrically.

g. Each alarm panel shall incorporate a 10.2” touch screen LCD display.

h. Alarm shall have a LCD touch screen display to allow for all alarm programming and set up on site without the use of tools.

i. Alarm shall have a green NORMAL condition on the home screen which shows that there are no alarms active.

j. The alarm home page includes a location/area served badge for the alarm panel, customizable with the keyboard feature of the touch screen during the set up process.

k. The alarm LCD display shall contain an adjustable background with many color/brightness options.

l. The alarm LCD display backlight includes a "sleep mode" option via motion sensor to preserve screen life, adjustable from 5 minutes to 60 minutes. By default, the alarm sleep mode option is not active and the backlight remains on all of the time. If option is active and an alarm occurs during "sleep mode", the backlight turns on and remains on during the alarm condition.

m. The alarm shall be able to provide a full diagnostic self-test testing the alarm signals (green and red), the LED indicators on the front panel, the audible horn, and displays all of the alarm set points. The test to be initiated with the touchscreen controls.

n. Green POWER ON LED indicator illuminates when the alarm panel is powered.

o. WARNING LED alerts the user to unused signals and communication issues which are not alarm causing conditions.

p. Audible HORN produces a minimum sound pressure level of 80 dBA measured at a distance of 3 ft. (.92m), adjustable to 90 dBA at 3 ft. (.92m).

q. MUTE button indicator LED flashes red during an alarm condition and remains illuminated as a constant red after silencing until the fault is corrected.

r. Medical Gas contractor to include as separate price all labor, materials, specialist subcontractors, programming and other costs required for full advertised functionality of alarm network. Contractor shall coordinate with owners

Information Technology (I.T.) personnel as required, but is not permitted to use owner's I.T. personnel for system installation.

s. Alarms shall be compatible with BACNet for building information system integration.

t. Alarm shall be factory capable of connection to the facility's Ethernet network for remote monitoring. Alarms shall require no special programming or software to allow remote interrogation through any computer or device on the same intranet. MGEM personnel shall be responsible for alarm configuration at no additional charge if required.

u. Provide owner with any software and manuals required for interface at time of commissioning at no additional charge.

2. Master Alarms:

a. Furnish exact duplicate Master Alarm Panels at the locations shown on the plans.

b. Wire the master alarm panel's alarms directly to the individual sensors/switches, furnishing duplicate sensors/switches as required for compliance with NFPA 99 5.1.9.2.4. Low voltage shielded wire shall be provided and installed by contractor installing the alarm panels.

c. Alarms shall be tested, labeled and fully operational for owner. Where alarm configuration in software is necessary, it shall be provided by MGEM representative at no additional charge.

d. Provide alarm points as indicated in NFPA 99 Table A.5.1.9.2. and as detailed on drawings.

3. Area Alarms:

a. Each area alarm shall include a rough in including power supply. Box must accommodate sensors for piped installation or allow for conduit connection for wired installations. Include sensor for each specific gas and gas specific DISS Demand check for each Sensor.

b. The power supply shall be of the universal switching type (100-250VAC, 50/60/440Hz, 120-300VDC). Power supply shall be fused to protect the system from voltage and amperage surges. Alarm shall clearly indicate when power is on.

c. The area alarm shall provide an audible and visual signal when an advisory or a fault signal is received. Signal limits shall be factory set, with the ability to be field adjusted without the use of tools.

d. Each panel shall allow continuous digital display of the vacuum or pressure, indicators for high pressure, and low pressure (or vacuum) and a Normal indicator.

e. The Sensor shall contain a transducer to drive the pressure display. Sensors shall include conduit mounting connector for wiring conduit.

f. The sensor shall include an indicator on the sensor housing allowing visual confirmation of sensor operation from floor level when the sensor is in the ceiling on the piping.

g. Furnish and install the alarm. Coordinate the power wiring with Division 16. Low voltage shielded signal wiring will be provided and installed by this contractor.

h. Termination of signal wiring at alarm location will be done by or under supervision of manufacturer of alarm.

i. Gas specific digital gas sensor contains a transducer capable of providing factory calibrated signals to the alarm panel.

j. Gas sensors may be located inside the alarm rough-in (local) or outside the alarm rough-in (remote).

k. When installed remotely, sensors may be located up to 1524 m (5,000 feet) from the alarm panel.

l. Pipeline connections are 3/8" nominal (1/2" OD) type K copper tube and include a DISS check fitting.

m. Digital gas sensors include a "heartbeat" flashing green LED light to designate that sensor is functioning correctly.

4. MEGA3 Master:

a. Master alarm panel monitors up to 40 normally closed dry contact switch signals wired locally.

b. Status for each signal, shown on the LCD screen, is Green under normal conditions (closed) and flashing Red under fault conditions (open).

c. During a fault condition, the visual green NORMAL display turns off, the location icon flashes red, the active alarm icon flashes red, and the audible alarm sounds.

d. Optional relay boards provide up to 48 dry contacts normally closed relays for connection to a bulding automation system. Relay ratings are 30 VAC/VDC 3A max.

e. Master alarms allow for optional relay outputs tied to single or multiple alarm conditions.

5. MEGA3 Combination:

a. Alarm panels monitor a combination of normally closed dry contact switch signals, digital gas sensor modules, and 4-20mA transducers.

b. Alarm panel capable of monitoring up to 30 normally closed dry contacts switch signals wired locally or up to 6 digital gas sensors.

6. TotalAlert Infinity:

a. Master alarm panels shall be fully compatible with owner's Ethernet network as supplied.

b. Alarm panels to allow users to set up customized instructions for each alarm signal, to appear on the screen when the signal is in alarm.

c. Customized instructions to be created with the touch screen interface on the alarm panel LCD.

d. Alarm to incorporate user-defined instructions into an emergency response plan by the facility.

e. Event log accessible on LCD display records alarms and panel activity, displays most recent 100 events.

f. Event log is downloadable through embedded web page, including most recent 1000 events.

g. Capability to capture and display (mirror) digital readings (pressure/vacuum levels) and source signals from other TotalAlert Infinity™ alarm panels via Ethernet.

h. Capability to customize alarm instructions on mirrored pressures and signals, enabling unique instructions at each panel.

i. All panels utilizing the built-in Ethernet connection capable for BACNet transmission of signals to a Building Automation System, no additional software or hardware required.

j. Alarms employ the TCP/IP family of protocols for communication and each device has a unique IP address.

k. Alarm panel conforms to the BACnet protocol and includes a Protocol Implementation Conformance Statement (PICS).

l. Alarm panels equipped with WiFi 802.11 b/g/n interface to provide access with any web enabled device to panel web page and retrieve operating information and event history.

m. With 4-20mA option, set up any 2 or 3 wire 4-20mA transducer with user defined values.

n. Ability to customize badges through the touchscreen interface to display the 4-20mA readings, including color, identification, location, value settings, and alarm set points (high and low), and customized alarm instructions.

o. Each 4-20mA monitored condition shows a separate green display when NORMAL and a red display when in ALARM.

7. TotalAlert Infinity Master:

a. Master alarm panel monitors up to 60 normally closed dry contact switch signals wired locally.

b. Monitor additional source signals from up to 8 remote TotalAlert Infinity™ alarm panels via Ethernet and display up to 320 master signals.

c. Display up to 320 master signals transmitted from other TotalAlert Infinity™ alarm panels via Ethernet or through Building Automation Systems via BACNet (mirroring).

d. Consolidated view provides an easy to read overview of all source equipment status, with 12 gas-type badges to group signals.

e. Status for each signal, shown on the touchscreen, is Green under normal conditions (closed) and flashing Red under fault conditions (open).

f. During a fault condition, the visual green NORMAL display turns off, the location icon flashes red, the active alarm icon flashes red, and the audible alarm sounds.

g. Optional relay boards provide up to 48 dry contacts normally closed relays for connection to a building automation system. Relay ratings are 30 VAC/VDC 3A max.

h. Master alarms allow for optional relay outputs tied to single or multiple alarm conditions.

8. TotalAlert Infinity Combination:

a. Alarm panels monitor a combination of normally closed dry contact switch signals, digital gas sensor modules, and 4-20mA transducers.

b. Alarm panel is capable of monitoring up to 60 normally closed dry contact switch signals wired locally and up to 6 digital gas sensors.

2.3 MEDICAL VACUUM PUMPS

A. Provide a complete medical vacuum source, complying with NFPA 99 5.1.3.6 in all respects, as specified and scheduled on the drawings and as manufactured by BeaconMedæs or pre approved equal.

B. All components shall be at least duplexed and valved (or check valved as provided in NFPA-99) to permit service to any component without interrupting vacuum supply to the facility during any maintenance operation or any condition of single fault failure. Each pump exhaust shall be isolated by a union fitting permitting capping for service removal.

C. Furnish complete plant consisting of pumps, receiver and controls capable of providing the scheduled capacity with one pump out of service. All capacities will be indicated in SCFM at 19 inches HG.

D. System shall be completely factory assembled, requiring only interconnection between modules on site. Systems requiring on site assembly other than interconnection are not acceptable (replacement of components removed for shipping is permitted).

E. Each pump will be direct or close coupled to a NEMA rated High Efficiency TEFC motor with a service factor of 1.15.

F. Each pump will include inlet and outlet flex connectors supplied by the MGEM.

G. The complete control system and all electrical components shall be UL labeled. The control system shall provide:

H. Automatic lead/lag sequencing including self adjusting minimum run timers which adaptively optimize the number of pump starts based on demand.

I. Circuit breaker disconnects for each vacuum pump with external operators. Units with fuses instead of circuit breakers in motor circuit are not acceptable. The control system shall include an automatic minimum run time adjustment to automatically adjust run time based on demand.

J. Full voltage motor starters with overload protection.

K. Redundant 120 volt control circuit transformers.

L. Visual and audible reserve unit alarm with isolated contacts for remote alarms and audio cancel.

M. Control cabinet shall have lighted HOA selector switches.

N. Panel mounted vacuum gauge.

O. Runtime hour-meter for each pump.

P. Provide oil lubricated rotary vane pumps, dynamically balanced multi vane design with heavy duty aluminum alloy vanes for maximum heat dissipation. Minimum vane life is 50,000 operation hours. Oil recirculation is differential pressure with full recirculation and multistage exhaust oil separation rated at not less than 99.998% efficiency. Each pump is provided with an oil non-return valve, filter change indicator for exhaust oil separation filters, and high discharge temperature switch. Service to the oil lubrication system filters does not require disconnection of the exhaust piping. The oil lubrication system shall all be enclosed in

one module to minimize oil leaks. Systems with external piping for oil lubrication are not acceptable. Systems requiring separate additional external electric motors for oil cooling are not acceptable. Rubber hose flex connectors and hose clamps are not acceptable for assembling package. Provide BeaconMedaes packaged vacuum system or preapproved equal.

2.4 LIQUEFIED BULK GAS SOURCES

A. The liquid bulk gas source(s) shall be provided by the gas supplier under separate contract with the Owner. Medical Gas Contractor to coordinate with supplier and verifier to ensure a complete and verified installation properly connected to the Medical Gas contractor's work.

B. The concrete equipment pad, concrete delivery pad and fencing shall be furnished under other divisions.

C. Lighting and electrical power shall be furnished and installed under Division 16. The Medical Gas Installer shall coordinate installation and connection of signal wiring to alarm panels.

D. Medical gas contractor shall install and verify prior to the installation of the liquid bulk gas source(s):

E. The main line from the equipment location to the building, stubbed up and capped at the equipment pad in the location determined by consultation with the Contractor installing the source.

F. The main line valve.

G. Emergency oxygen inlets, with supply line and associated components in locations as required by NFPA 99 5.1.3.4.14, as otherwise in accordance with NFPA 99, and as indicated on the drawing. Emergency oxygen supply connection shall be as manufactured by BeaconMedæs.

H. If the Emergency Oxygen Inlet location as shown on drawings is not found to be accessible by delivery vehicles for any reason, inform the engineer for possible relocation prior to final installation.

I. Gas Cylinder Manifolds:

1. Manifolds shall meet the requirements of NFPA 99 5.1.3.5. and be tested according to ISO 10524-2 for adiabatic compression and flow.

2. The manifold control(s) shall be fully automatic, including shifting to secondary bank when the service bank is exhausted, with automatic reset of replaced bank to primary status. Semi-automatic manifolds are not acceptable.

3. Manifolds shall be easily installed including provision for premounting manifold bracket and zero clearance unions at outlet, vent and reserve header (if equipped).

4. The manifold control(s) shall incorporate:

a. Pressure switches or transducers to actuate designated signals when service bank is exhausted.

b. Visible display on control unit to determine when primary bank is exhausted and the secondary bank is in operation.

c. A continuously lit green indicator to indicate header in use.

d. Gauges to indicate contents of each header.

e. An green indicator of header ready for the secondary header.

f. A red indicator of header empty for each header.

g. A pressure gauge for line pressure.

h. Service vent valve piped to vent line for manifold testing.

5. Manifold design shall ensure that the failure of any one component does not prevent continued supply of gas to patients.

6. Bank regulators shall be:

a. Dome biased and shall not require heaters for any gas.

b. Balanced design for minimum opening pressure.

c. Piston design for positive reassembly at service.

7. Manifolds shall utilize a forged flowpath design with integral connections, regulators, and control valves to mimimize potential gas loss and shall be provided with an emergency reserve tap appropriate for connection of a reserve header.

8. Manifold power supply shall be integral, prewired unit for ease of installation. Wiring between manifold and power supply shall be factory supplied. Manifolds requiring electrical work inside the manifold cabinet during installation are not acceptable.

9. Power supply box shall include terminals for all NFPA mandated alarm signals per Table A-5.1.9.2.

10. Manifolds shall be designed and constructed to prevent adiabatic ignition and have the following:

a. For Oxygen, oxygen mixtures, and helium, furnish Copper pigtails. Flexible leads with polymeric linings are not acceptable.

b. For all other gases, Flexible leads with polymeric linings are acceptable.

c. Cylinder check valves shall contain no Teflon or Kel-F.

d. Header valves shall be furnished with copper seats.

e. Include no NPT or other connections requiring tape or dope sealants.

f. Use only HBNR for primary regulator.

11. Manifolds shall be designed and constructed for either indoor or outdoor use and be rated IP 66 / NEMA 4.

12. Manifolds shall be designed to permit cylinders to be placed under the manifold controls.

13. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the anticipated number of cylinders while attached to the manifolds.

14. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the number of cylinders indicated on the plans while in storage.

15. Manifolds using gauges which require electrical power are not acceptable.

16. Manifolds which cannot perform switching operations as per NFPA 99 5.1.3.5.10.5 without electrical power are not acceptable.

17. Manfolds shall be Ethernet capable for remote monitoring using any web-enabled device.

18. Manifolds shall be BeaconMedæs LifeLine series with sizes as scheduled on the plans.

J. Liquid Container Manifolds:

1. Manifolds shall meet the requirements of NFPA 99 5.1.3.5. and be tested according to ISO 10524-2 for adiabatic compression and flow.

2. The manifold control(s) shall be fully automatic, including shifting to secondary bank when the primary bank is exhausted with automatic reset of replaced bank to reserve status. Semi-automatic manifolds are not acceptable.

3. Manifolds shall be easily installed including provision for premounting manifold bracket and zero clearance unions at outlet, vent and reserve header (if equipped).

4. The manifold control(s) shall incorporate:

a. Pressure switches or transducers to actuate designated signals when service bank is exhausted.

b. Visible display on control unit to determine when primary bank is exhausted and the secondary bank is in operation.

c. A continuously lit green indicator to indicate header in use.

d. Gauges to indicate contents of each header.

e. An green indicator of header ready for the secondary header.

f. A red indicator of header empty for each header.

g. A pressure gauge for line pressure.

h. Service vent valve piped to vent line for manifold testing.

5. Manifold shall include all reserve header components necessary to complete a manifold with reserve. Header shall include at least the number of connections scheduled on the plans.

6. Reserve headers shall be separate sub assemblies suitable for mounting separate from the manifold controls using standard Type K tubing and brazing techniques. No special piping materials or techniques shall be required.

7. Manifold design shall ensure that the failure of any one component does not prevent continued supply of gas to patients.

8. Manifolds shall utilize a forged flowpath design with integral connections, regulators, and control valves to mimimize potential gas loss and shall be provided with an emergency reserve tap appropriate for connection of a reserve header.

9. Manifold power supply shall be integral, prewired unit for ease of installation. Wiring between manifold and power supply shall be factory supplied. Manifolds requiring electrical work inside the manifold cabinet during installation are not acceptable.

10. Power supply box shall include terminals for all NFPA mandated alarm signals per Table A-5.1.9.2.

11. Bank regulators shall be:

    a. Dome biased and shall not require heaters for any gas.

    b. Balanced design for minimum opening pressure.

    c. Piston design for positive reassembly at service.

12. Oxygen reserve headers shall not include polymeric materials.

    a. Furnish Copper pigtails. Flexible leads with polymeric linings are not acceptable.

    b. Cylinder check valves shall contain no Teflon or Kel-F.

    c. Header valves shall be furnished with copper seats.

13. Contractor shall furnish and install or field fabricate cylinder storage racks adequate to restrain the anticipated number of containers and cylinders while attached to the manifolds.

14. Contractor shall furnish and install or field fabricate storage racks adequate to restrain the number of containers and cylinders indicated on the plans while in storage.

15. Manifolds shall be designed and constructed for either indoor or outdoor use and be rated IP 66 / NEMA 4.

16. Manifolds using gauges which require electrical power are not acceptable.

17. Manifolds which cannot perform switching operations as per NFPA 99 5.1.3.5.10.5 without electrical power are not acceptable.

18. Manifolds shall be Ethernet capable for remote monitoring using any web-enabled device.

19. Manifolds shall be BeaconMedæs LifeLine series with sizes as scheduled on the plans.

20. Manufacturer shall include with the manifold one copy of an applications guide describing the operation of liquid manifolds and their limitations for the operator's use.

K. Manifold Room Monitors:

1. Furnish each manifold room with an oxygen depletion monitor mounted in the manifold room at 1.3 meters (4 feet) AFF in a position where cylinders will not contact the sensor or meter. Monitors indicate oxygen low level at 19.5% and a second indication at 18%. Audible and visual indication is provided.

2. Provide audible and visual indicator outside door at 1.5 meters (5 feet) AFF to alert operator prior to entry. Label "Oxygen Low - Do Not Enter".

3. Monitors are provided with volt free contact for connection to master alarm.

PART 3 EXECUTION

3.1 INSTALLATION

A. Bases and Site preparation:

1. Contractor shall furnish 4 inch high concrete housekeeping pads under all medical air, instrument air, vacuum and WAGD plant in this section. Refer to Division 3 for formwork, reinforcement and concrete requirements.

2. Contractor shall furnish inertia bases in lieu of housekeeping pads where the equipment installed is not factory isolated by the manufacturer.

3. Cast anchor bolts into bases.

B. Pipe work:

1. All installation shall be performed in strict accordance with NFPA 99 5.1.10. Brazing procedures shall be as detailed in NFPA 99 5.1.10.5. Brazing shall be performed only by brazers qualified under NFPA 99 5.1.10.10.11.

2. Where piping runs underground, install in accordance with NFPA 99 5.1.10.10.5.

3. Copper, tubing, valves and fittings shall be pre cleaned and prepared for oxygen service by the manufacturer and received sealed on the job. Certificates of origin and of proper preparation shall be maintained on the job site attesting the above.

4. The use of flux is prohibited when making of joints between copper to copper pipes and fittings.

5. During any brazing operation, the interior of the pipe shall be purged continuously with oil free, dry nitrogen NF, following the procedure in NFPA 99 5.1.10.5.5. At the completion of any section, all open pipe ends shall be capped using an EXTERNAL cap.

6. Threaded joints in piping systems shall be avoided whenever possible. Where unavoidable, make up the male threads with polytetrafluorofethylene (such as Teflon) tape. Do not use liquid sealants.

7. Piping shall be supported with pipe trays or hangers at intervals as shown on the drawings or as defined in NFPA 99 Table 5.1.10.10.4.5. Piping shall not be supported by other piping. Isolation of copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as an isolation material.

8. After installation of the piping, but before installation of the outlet valves, blow lines clear using nitrogen NF.

9. Piping exposed to physical damage shall be protected.

10. Label piping with name of gas service, identification color and direction of flow. Where non-standard pressures are piped, label for pressure. Labels shall be placed at least once every 20 feet of linear run or once in each story (whichever is more frequent). A label shall additionally be placed immediately on each side of each wall or floor penetration. Pipe labels shall be self adhesive vinyl or other water resistant material with permanent adhesive colored in accordance with NFPA 99 Table 5.1.11 and shall be visible on all sides of the pipe. Pipe labels shall be BeaconMedæs Series 6-435.

11. Alarms and valves shall be labeled for gas service and areas monitored or controlled. Coordinate with owner for final room or area designations. Label valves with name and identification color of the gas and direction of flow.

12. Piping penetrating an electromagnetic shield shall have an isolation device on each side of shield.

C. Labeling:

1. 1. Label the medical gas pipelines per NFPA 99 5.1.11 and as follows:

    a. a. Label each master alarm signal for function after ring out.

    b. b. Label each zone valve and area alarm for the area of control or surveillance after test.

2. Labels shall be permanent and of a type approved by the owner.

3.2 INSTALLER TESTING

A. Prior to declaring the lines ready for final verification, the installing contractor shall follow strictly the procedures for verification as described in NFPA 99 5.1.12.2 and attest in writing over the notarized signature of an officer of the installing company the following:

1. That all brazing was conducted by brazers qualified to ASSE 6010 and holding current medical gas endorsements.

2. That all brazing was conducted with nitrogen purging. (Procedure per NFPA 99 5.1.10.5.5).

3. That the lines have been blown clear of any construction debris using oil free dry nitrogen or air are clean and ready for use. (Procedure per NFPA 99 5.1.12.2.2).

4. That the car case leak test was completed (Procedure per NFPA 99 5.1.12.2.3).

5. That the assembled piping, prior to the installation of any devices, maintained a test pressure 1 1/2 times the standard pressures listed in NFPA 99 Table 5.1.11 without leaks. Attestation shall include the signature, date, agency and title of the witnessing Authority Having Jurisdiction (Procedure per NFPA 99 5.1.12.2.3).

6. That after installation of all devices, the pipeline was proven leak free for 24 hours at a pressure 20% above the standard pressures listed in NFPA 99 Table 5.1.11. (Procedure per NFPA 99 5.1.12.2.2.6).

7. That the systems have been checked for cross connections and none were found. (Procedure per NFPA 99 5.1.12.2.4).

8. That the manufacturer has started up all medical air compressors, medical vacuum pumps WAGD producers, liquid oxygen system(s) and manifolds, and that they are in operating order.

B. Provide four originals of the affidavit, distributed; (1) to the engineer, (1) to the owners representative, (1) to the general contractor and (1) to the verifier.

3.3 VERIFIER TESTING

A. Prior to handing over the systems to the owner, contractor shall retain a Verifier acceptable to the engineer and owner who shall follow strictly the procedures for verification as described in

NFPA 99 5.1.12.3 and provide a written report and certificate bearing the notarized signature of an officer of the verification company which contains at least the following:

1. A current ACORD insurance certificate indicating professional liability coverage in the minimum amount of $1 Million per occurrence, and general aggregate liability in the minimum amount of $1 Million, valid and in force when the project is to be verified. General liability insurance is not alone acceptable.

2. A listing of all tests performed, listing each source, outlet, valve and alarm included in the testing.

3. An assertion that all tests were performed by a MGPHO Certified Medical Gas Verifier (CMGV) or by individuals qualified to perform the work and holding valid qualifications to ASSE 6030 and under the immediate supervision a CMGV Verifier. Include the names, credential numbers and expiration dates for all individuals working on the project.

4. A statement that equipment used was calibrated at least within the last six months by a method traceable to a National Bureau of Standard Reference and enclosing certificates or other evidence of such calibration(s). Where outside laboratories are used in lieu of on site equipment, those laboratories shall be named and their original reports enclosed.

5. A statement that where and when needed, equipment was re-calibrated during the verification process and describing the method(s) used.

6. A statement that the systems were tested and found to be free of debris to a procedure per NFPA 99 5.1.12.3.7.

7. The flow from each outlet when tested to a procedure per NFPA 99-5.1.12.3.10.

8. A statement that the systems were tested and found to have no cross-connections to a procedure per NFPA 99 5.1.12.3.3.

9. A statement that the systems were tested and found to be free of contaminants to a procedure per NFPA 99 5.1.12.3.8 except that the purity standard shall be 2 ppm difference for halogenated hydrocarbons and 1 ppm total hydrocarbons (as methane).

10. A statement that all local signals function as required under NFPA 99 5.1.3.4.7 and as per the relevant NFPA 99 sections relating to the sources.

11. A listing of local alarms, their function and activation per NFPA 99 5.1.12.3.14.

12. A listing of master alarms, their function and activation, including pressures for high and low alarms per NFPA 99 5.1.12.3.5.2.

13. A listing of area alarms, their function and activation pressures per NFPA 99 5.1.12.3.5.3.

14. A statement that the sources include all alarms required by NFPA 99 Table A.5.1.9.5.

15. The concentration of each component of NFPA 99 Table 5.1.12.3.12 in the medical air after 24 hours of operation of the medical air source.

16. The concentration of each gas at each outlet as specified in NFPA 99 5.1.12.3.11.

17. A statement that all valves and alarms are accurately labeled as to zone of control.

B. Provide four originals of this affidavit, and report, distributed; (1) to the engineer, (1) to the owner's representative, (1) to the general contractor and (1) to the installing contractor.

END OF SECTION