DIVISION 22: PLUMBING

END TABLE OF CONTENTS

SECTION 22 0100 - COMMON PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Furnish labor, materials, and equipment necessary for completion of work as described in Contract Documents.

B. It is the intent of these specifications that the systems specified herein are to be complete and operational before being turned over to the owner. During the bidding process, the contractor is to ask questions or call to the engineer's attention any items that are not shown or may be required to make the system complete and operational. Once the project is bid and the contractor has accepted the contract, it is his responsibility to furnish and install all equipment and parts necessary to provide a complete and operational system without additional cost to the owner.

C. Furnish and install fire stopping materials to seal penetrations through fire rated structures and draft stops.

1.3 SUBMITTALS

A. Substitutions: By specific designation and description, standards are established for specialties and equipment. Other makes of specialties and equipment of equal quality will be considered provided such proposed substitutions are submitted to the Architect for his approval, complete with specification data showing how it meets the specifications, at least 5 working days prior to bid opening. A list of approved substitutions will be published as an addendum but does not relieve Contractor from meeting all requirements of the specifications.
   1. Submit a single copy of Manufacturer's catalog data including Manufacturer's complete specification for each proposed substitution.
   2. The Architect or Engineer is to be the sole judge as to the quality of any material offered as an equal.

B. Product Data, Shop Drawings: Within 30 days after award of contract, submit electronic copies of Manufacturer's catalog data for each manufactured item.
   1. Literature shall include enough information to show complete compliance with Contract Document requirements.
   2. Mark literature to indicate specific item with applicable data underlined.
   3. Information shall include but not be limited to capacities, ratings, type of material used, guarantee, and such dimensions as are necessary to check space requirements.
   4. When accepted, submittal shall be an addition to Contract Documents and shall be in equal force. No variation shall be permitted.
   5. Even though the submittals have been accepted by the Engineer, it does not relieve the contractor from meeting all of the requirements of the plans and specifications and providing a complete and operational system.

C. Drawings of Record: One complete set of mechanical drawings shall be provided for the purpose of showing a complete picture of the work as actually installed.
   1. These drawings shall serve as work progress report sheets. Contractor shall make notations neat and legible therein daily as the work proceeds.
   2. The drawings shall be kept at the job at a location designated by the Mechanical Engineer.
   3. At completion of the project these "as-built" drawings shall be signed by the Contractor, dated, and returned to the Architect.

D. Operating Instructions and Service Manual: The Mechanical Contractor shall prepare 2 copies of an Operation and Maintenance Manual for all mechanical systems and equipment used in this project.

Manuals shall be bound in hard-backed binders and the front cover and spine of each binder shall indicate the name and location of the project. Use plastic tab indexes for all sections. Provide a section for each different type of equipment item. The following items shall be included in the manual, together with any other pertinent data. This list is not complete and is to be used as a guide.

1. Provide a master index at the beginning of the manual showing all items included.
2. The first section of the manual shall contain:
    a. Names, addresses, and telephone numbers of Architect, Mechanical Engineer, Electrical Engineer, General Contractor, Plumbing Contractor, Sheet Metal Contractor, and Temperature Control Contractor.
    b. List of Suppliers which shall include a complete list of each piece of equipment used with the name, address, and telephone number of vendor.
    c. General Description of Systems including –
        1) Location of all major equipment
        2) Description of the various mechanical systems
        3) Description of operation and control of the mechanical systems
        4) Suggested maintenance schedule
    d. Copy of contractor's written warranty
3. Provide a copy of approved submittal literature for each piece of equipment.
4. Provide maintenance and operation literature published by the manufacturer for each piece of equipment which includes: oiling, lubrication and greasing data; belt sizes, types and lengths; wiring diagrams; step-by-step procedure to follow in putting each piece of mechanical equipment in operation.
5. Include parts numbers of all replaceable items.
6. Provide control diagram and operation sequence, along with labeling of control piping and instruments to match diagram.
7. Include a valve chart indicating valve locations.
8. Include air balance and/or water balance reports.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
    1. Perform work in accordance with applicable provisions of local and state Plumbing Code, Gas Ordinances, and adoptions thereof. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
    2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Promptly notify Architect in writing of such differences.

B. Applicable Specifications: Referenced specifications, standards, and publications shall be of the issues in effect on date of Advertisement for Bid.
    1. "Heating, Ventilating and Air Conditioning Guide" published by the American Society of Heating and Air Conditioning Engineers.
    2. "Engineering Standards" published by the Heating, Piping, and Air Conditioning Contractors National Association.
    3. "2018 International Building Code", "2018 International Mechanical Code", and "2018 International Fire Code" as published by the International Conference of Building Officials.
    4. “2017 Idaho Plumbing Code” as published by the International Association of Plumbing and Mechanical Officials.
    5. "National Electrical Code" as published by the National Fire Protection Association.
    6. "2018 International Energy Conservation Code ".

1.5 INSPECTIONS AND PERMITS

A. Pay for permits, fees, or charges for inspection or other services. Local and state codes and ordinances must be properly executed without expense to Owner and are considered as minimum requirements. Local and state codes and ordinances do not relieve the Contractor from work shown that exceeds minimum requirements.

1.6 ADDITIONAL WORK:

A. Design is based on equipment as described in the drawing equipment schedule. Any change in foundation bases, electrical wiring, conduit connections, piping, controls and openings required by alternate equipment submitted and approved shall be paid for by this division. All work shall be in accordance with the requirements of the applicable sections.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Inspection:
   1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.
   2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

B. Drawings:
   1. Plumbing drawings show general arrangement of piping, equipment, etc, and do not attempt to show complete details of building construction which affect installation. This Contractor shall refer to architectural, structural, mechanical, and electrical drawings for additional building detail which affect installation of his work.
      a. Follow plumbing drawings as closely as actual building construction and work of other trades will permit.
      b. No extra payments will be allowed where piping and/or ductwork must be offset to avoid other work or where minor changes are necessary to facilitate installation.
      c. Everything shown on the plumbing drawings shall be the responsibility of Plumbing Contractor unless specifically noted otherwise.
   2. Consider architectural and structural drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over mechanical drawings.
   3. Because of small scale plumbing drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions. Do not scale drawings for locations of equipment or piping. Refer to large scale dimensioned drawings for exact locations.

C. Insure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.
   1. If approval is received to use other than specified items, responsibility for specified capacities and insuring that items to be furnished will fit space available lies with this Division.
   2. If non-specified equipment is used and it will not fit job site conditions, this Contractor assumes responsibility for replacement with items named in Contract Documents.

D. Be aware that there are 2 separate parts of this building. The “Product Process Area”, which requires all food grade stainless steel piping, waste, and facilities. The area 1 “Office and Toilet areas”, which require standard commercial piping, fixtures, and facilities.

3.2 PREPARATION

A. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.
   1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials.
   2. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

3. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

3.3 INSTALLATION

A. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, starters, motors, control components, and to clear openings of doors and access panels.

3.4 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and assume complete responsibility for losses due to any cause whatsoever. Storage shall not interfere with traffic conditions in any public thoroughfare.

B. Protect completed work, work underway, and materials against loss or damage.

C. Close pipe openings with caps or plugs during installation. Cover fixtures and equipment and protect against dirt, or injury caused by water, chemical, or mechanical accident.

3.5 EXCAVATION AND BACKFILL

A. Perform necessary excavation of whatever substance encountered for proper laying of all pipes and underground ducts.
   1. Excavated materials not required for fill shall be removed from site as directed by Engineer.
   2. Excavation shall be carried low enough to allow a minimum coverage over underground piping of 5'-0" or to be below local frost level.
   3. Excess excavation below required level shall be backfilled at Contractor's expense with earth, sand, or gravel as directed by Engineer. Tamp ground thoroughly.
   4. Ground adjacent to all excavations shall be graded to prevent water running into excavated areas.

B. Backfill pipe trenches and allow for settlement.
   1. Backfill shall be mechanically compacted to same density as surrounding undisturbed earth.
   2. Cinders shall not be used in backfilling where steel or iron pipe is used.
   3. No backfilling shall be done until installation has been approved by the Engineer.

3.6 COOPERATION

A. Cooperate with other crafts in coordination of work. Promptly respond when notified that construction is ready for installation of work under Division 22. Contractor will be held responsible for any delays which might be caused by his negligence or failure to cooperate with the other Contractors or crafts.

3.7 SUPERVISION

A. Provide a competent superintendent in charge of the work at all times. Anyone found incompetent shall be removed at once and replaced by someone satisfactory, when requested by the Architect.

3.8 INSTALLATION CHECK:

A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule shall visit the project to inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the project as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.

B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying the following:
   1. Equipment has been properly installed and lubricated.
   2. Equipment is in accurate alignment.
   3. Equipment is free from any undue stress imposed by connecting piping or anchor bolts.
   4. Equipment has been operated under full load conditions.

5. Equipment operated satisfactorily.

C. All costs for this installation check shall be included in the prices quoted by equipment suppliers.

3.9 CLEANING EQUIPMENT AND PREMISES

A. Properly lubricate equipment before Owner's acceptance.

B. Clean exposed piping, equipment, and fixtures. Repair damaged finishes and leave everything in working order.

C. Remove stickers from fixtures and adjust flush valves.

D. Trap elements shall be removed during cleaning and flushing period. Replace trap elements and adjust after cleaning and flushing period.

3.10 TESTS

A. No piping work, fixtures, or equipment shall be concealed or covered until they have been inspected and approved by the inspector. Notify inspector when the work is ready for inspection.

B. All work shall be completely installed, tested as required by Contract Documents and the city and county ordinances and shall be leak-tight before the inspection is requested.

C. Tests shall be repeated to the satisfaction of those making the inspections.

D. Water piping shall be flushed out, tested at 100 psi and left under pressure of supply main or a minimum of 40 psi for the balance of the construction period.

3.11 WARRANTEE

A. Contractor shall guarantee work under Division 22 to be free from inherent defects for a period of one year from acceptance.
   1. Contractor shall repair, revise or replace any and all such leaks, failure or inoperativeness due to defective work, materials, or parts free of charge for a period of one year from final acceptance, provided such defect is not due to carelessness in operation or maintenance.

B. In addition to warrantee specified in General Conditions and plumbing systems are to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

3.12 SYSTEM START-UP, OWNER'S INSTRUCTIONS

A. Owner's Instructions
   1. Instruct building maintenance personnel and Owner Representative in operation and maintenance of mechanical systems utilizing Operation & Maintenance Manual when so doing.
   2. Minimum instruction periods shall be as follows –
      a. Plumbing - Four hours.
   3. Instruction periods shall occur after Substantial Completion inspection when systems are properly working and before final payment is made.
   4. None of these instructional periods shall overlap another.

END OF SECTION 22 0501

SECTION 22 0503 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. General valve materials and installation procedures for all piping systems in non-process areas.

B. Valve materials and installation procedures for all piping systems from the boiler room to and connections in the process area must be 316 stainless steel with a minimum pressure rating of 400 psi. They will be installed and attached to the stainless steel piping specified for that area.

1.3 QUALITY ASSURANCE

A. Manufacture:
1. Use domestic made valves where possible.

B. General: Support components shall conform to Manufacturer's Standardization Society Specification SP-58.

PART 2 - PRODUCTS

2.1 VALVES

A. Ball Valves:
1. 2" and smaller for domestic and heating hot water service:
2. Construction, 2 inches and smaller: MSS SP-110, Class 150, 400 psi CWP, 316 S.S., two piece body, 316 S.S ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, level handle with balancing stops.
3. 2½” and larger - 3 piece full port, 316 S.S., flanged 400# WOG with seats rated for temperature service.
4. Ball valves shall be used where ever possible.

B. Butterfly Valves:
1. Construction 2-1/2 inches and Larger: MSS SP-67, 200 psi CWP, 316 S.S. resilient replaceable EPDM seat, wafer ends, extended neck, 10 position S.S. lever handle.
2. Butterfly valves may be used in lieu of ball valves where temperature and pressure allow.

C. Cutoff service valves shall be ball Valves:

D. Valves used in bypasses and for throttling service shall be ball valves:

E. Flow Control Valves
1. Manufacturers
    1. ITT Bell & Gossett: www.bellgosett.com
    2. Griswold Controls: www.giswoldcontrols.com
2. Construction: Class 125, 316 S.S. with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/blackflush drain.
3. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 305 psi.

F. Swing Check Valves
1. Up to 2 inches:
   a. MSS SP-80, Class 125. Bronze body and cap, bronze swing disc with rubber seat, solder ends.
2. Over 2 Inches:
   a. MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

G. Relief Valves
1. Pressure Relief
   a. Manufacturers
      1. Tyco Flow Control: www.tycoflowcontrol.com
      2. Cla-Val Co: www.cla-val.com
      3. Henry Technologies: www.henrytech.com
      4. Watts Regulator Company: www.wattsregulator.com
   b. AGA Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.
2. Temperature and Pressure Relief
   a. Manufacturers:
      1. Cla-Vol Co: www.cla-val.com
      2. Henry Tecnologies: www.henrytech.com
      3. Watts Regulator Company: www.watssregulator.com

H. Strainers
1. Size 2 inch and under:
   a. Threaded 316 S.S. for 175 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen.
2. Size 1-1/2 inch to 4 inch:
   a. Class 125. Flanged 316 S.S., Y pattern with 1/6- inch stainless steel perforated screen.

I. Use ball valves or butterfly valves everywhere unless noted otherwise.

J. Approved Manufacturers:
1. Nibco
2. Hammond
3. Stockham
4. Milwaukee
5. Victaulic

END OF SECTION 22 0503

SECTION 22 0529 – HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. General hangers and support and installed procedures for all stainless steel plumbing piping systems in process area and the boiler room.

B. General hangers and support and install procedure for the standard commercial building construction may be used for all piping in the non-process areas that do not require stainless steel piping.

1.3 QUALITY ASSURANCE

A. Manufacture:
1. Use domestic made valves, pipe and pipe fittings.

B. General: Support components shall conform to Manufacturer's Standardization Society Specification SP-58.

PART 2 - PRODUCTS

2.1 PIPE HANGERS

A. Adjustable, 316 S.S. clevis type of a diameter adequate to support pipe size.

B. Approved Manufacturers:
1. B-Line Systems
2. Grinnell
3. Kin-Line
4. Superstrut

2.2 EXPANSION JOINTS

C. Install at all building expansion joints and as shown on the drawings, flexible, or nipple/flexible coupling type 316 S.S. combinations for added expansion/deflection. Submit Manufacturer’s data.

D. Approved Manufacturers
1. Victaulic
2. Grinnell
3. Garlock
4. Vibration Mountings & Controls, Inc.

2.3 SLEEVES

E. Sleeves shall 316 S.S. metal two sizes larger than pipe or insulation.

2.4 INTERMEDIATE ATTACHMENTS

F. Continuous threaded 316 S.S. rod may be used wherever possible.

G. No chain, wire, or perforated strap shall be used.

2.5 FLOOR AND CEILING PLATES

H. 316 S.S.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install complete system of 316 S.S piping, with hangers and supports or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Contractor from responsibility for proper erection of systems of piping with all needed hangers and supports.

B. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
   1. Cut piping accurately for fabrication to measurements established at site and work into place without springing or forcing.
   2. Do not use pipe hooks, chains, or perforated metal for pipe support.
   3. Remove burr and cutting slag from pipes.
   4. Make changes in direction with proper fittings.
   5. Support piping at 8 feet on center maximum for pipe 1-1/4 inches or larger and 6 feet on center maximum for pipe one inch or less. Provide support at each elbow. Install additional support as required.
   6. Suspend piping from roof trusses or clamp to vertical walls using 316 S.S. Unistrut and clamps (except underground pipe). Laying of piping on any building member is not allowed.

C. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.

D. Provide sleeves around pipes passing through floors, walls, partitions, or structural members.
   1. Seal sleeves with plastic or other acceptable material.
   2. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

3.2 HORIZONTAL PIPING INSTALLATION

E. Locate hangers, supports, and anchors near or at changes in piping direction and concentrated loads.

F. Provide for vertical adjustment to maintain pitch required for proper drainage.

G. Allow for expansion and contraction of the piping.

3.3 PIPE SLEEVES AND INSERTS

H. Set sleeves before concrete is poured or floors finished.

I. Inserts for units should be placed in the concrete or masonry during construction to avoid cutting of finished work. When and if cutting becomes necessary, it must be done in accordance with the cutting and patching specifications.

3.4 FLOOR AND CEILING PLATES

J. Install 316 S.S. plates on all pipes passing through floors, partitions, and ceilings.

END OF SECTION 22 0529

SECTION 22 0548 – VIBRATION AND SEISMIC CONTROL FOR PLUMBING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install engineering, labor, material, and equipment necessary for a complete anchorage and seismic restraint system and vibration isolation system as described in Contract Documents.
   1. The system design and installation shall be based on Seismic Zone III of the Uniform Building Code and other standards listed below.
   2. The work shall include all mechanical isolated and non- isolated equipment, ducts and piping systems which shall include:
      a. Water heaters and booster heaters.
      b. Expansion tanks.
      c. Air compressors.
      d. Pumps.
      e. All piping 2-1/2" and larger except waste, vent and roof drainage piping.

B. Any devices or supports located in the process area of the building shall be 316 stainless steel.

1.3 REFERENCE STANDARDS

A. Uniform Building Code, Current Edition

B. NFPA Bulletin 90A, Current Edition

C. UL Standard 181

D. Tri-Services Manual, Fagel Et Al

E. MACNA Guidelines for Seismic Restraints of Mechanical Systems

1.4 SEISMIC REQUIREMENTS & QUALIFICATIONS

A. The Plumbing Contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the current code. All supports, hangers, bases, braces and anchorage for all non-isolated equipment, and piping shall be installed as detailed and specified in the contract documents. Specific requirements on equipment anchorage and restraints, locations and sizes shall be furnished to the contractor after shop drawings for mechanical equipment have been reviewed and approved. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal.

B. The Contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed from the Equipment Shop Drawings certified correct by the equipment manufacturer for Seismic Zone III with direct anchorage capability.

1.5 SUBMITTALS

A. Submittal data prior to fabrication, shall include but not be limited to the following:
   1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.
   2. The professional stamp of the engineer who is responsible for the design of the Vibration and Seismic Restraint System for isolated equipment.
   3. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
   4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.
   5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.
   6. The proposed location of pipe restraints.

PART 2 - PRODUCTS

2.1 RESTRAINT EQUIPMENT

A. Manufacturer of restraint equipment for isolated equipment shall be the manufacturer of the vibration isolators furnished for the equipment. Design of restraints and anchors for isolated equipment shall also be by the manufacturer.

B. Approved Manufacturers and Suppliers:
   1. Manufacturers and suppliers of restraint equipment and systems approved for use by the Contractor, for isolated and non-isolated systems, are Mason Industries. Inc., Korfund, Amber/Booth Company, Vibration Mountings & Control Co. or prior approved equal.

C. Any items used in the product area of the building must be type 316 S.S.

PART 3 - EXECUTION

3.1 SEISMIC REQUIREMENTS

A. All plumbing equipment and piping shall be braced, snubbed or supported to withstand seismic disturbances and remain operational. Furnish all engineering, labor, materials and equipment to provide protection against seismic disturbances as specified herein.

B. Isolated Equipment:
   1. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. The snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials.
   2. Elastomeric material shall be replaceable and a minimum of 3/4" thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" nor more than 1/4". Snubbers shall be installed with factory set clearances. Snubbers shall be equal to Mason Z-1011.
   3. A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.

C. Piping:
   1. All isolated and non-isolated piping 2-1/2" I.D. and larger shall be protected in all planes by restraints to accommodate thermal movement as well as restrain seismic motion. Locations shall be as scheduled and shall include but not be limited to:
      a. At all drops to equipment and at flexible connections.
      b. At all 45° or greater changes in direction of pipe.
      c. At horizontal runs of pipe, not to exceed 30 feet O.C. spacing.

d. Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.
e. Shop drawings shall be submitted with the locations of all restraints shown on a floor plan and noting the size and type of restraint to be used.
f. Gas piping shall have additional restraints as scheduled.

D. Non Isolated Equipment:
1. The restraint systems for all non isolated equipment shall be designed according to Table 23J, sec. 2312 of the Uniform Building Code with an importance factor of 1.5, a site factor Z = 0.75 and a Cp = 0.3. Horizontal force factor for elements of structures. In addition, the vertical forces restraint requirement shall be computed as 1/2 the value of the horizontal forces. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

3.2 VIBRATION ISOLATION REQUIREMENTS

A. All plumbing equipment 1 horsepower and over, unless otherwise noted, shall be isolated from the structure by means of resilient vibration and noise isolators designed and supplied by the manufacturer supplying seismic design and equipment. All piping shall be isolated from the structure. Isolation equipment, hangers, connections, and other isolating devices shall be designed and installed to prevent transmission of vibration to the structure from the mechanical equipment or any associated piping and ductwork. All isolation systems shall be designed and installed to provide isolation efficiency of 98 percent.

B. Vertical pipe risers shall be isolated from the structure by means of vibration and noise isolating expansion hangers. The hangers shall have a minimum rated deflection of four times the anticipated pipe movement and shall be enclosed in a housing for fail-safe equipment.

C. Flexible members shall be incorporated in the piping adjacent to all reciprocating equipment.

END OF SECTION 22 0548

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPES AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes but Not Limited To:
1. Furnish and install identification of plumbing piping and equipment as described in Contract Documents.

PART 2 - PRODUCTS

2.1 LABELS

A. Black Formica with white reveal on engraving.

2.2 CODED BANDS

A. Using colored bands and arrows to indicate supply and return, with colored reflective tape, color code all piping installed in this contract at not more than 20-foot intervals, at equipment at walls, etc., in accordance with ANSI Standards.

B. Approved Manufacturers:

1. Seton

2. Craftmark

2.3 PIPE IDENTIFICATION

A. Seaton coded and colored pipe markers and arrows to meet ANSI Standards.

2.4 EQUIPMENT IDENTIFICATION

A. Provide an engraved plastic plate for each piece of equipment stating the name of the item, symbol number, area served, and capacity. Label all control components with plastic embossed mechanically attached labels. Sample: Hot Water Heat Exchanger 5 GPM @ 140 Degrees

2.5 VALVE IDNETIFICATION

A. Make a list of and tag all valves installed in this work.

1. Valve tags shall be of stainless steel, not less than 1”X2” size, hung with S.S. chains.

2. Tag shall indicate plumbing or heating service.

PART 3 - EXECUTION

3.1 SCHEDULES

A. Pipe Identification Schedule:
1. Apply symbols as follows:

Pipe Use	Abbreviation
Domestic Cold Water	CH
Domestic Hot Water	HW
Domestic Recirc Water	HWR

3.2 APPLICATION

1. Identify thermostats and control panels in mechanical rooms, hot water heating specialties, condensing units with following data engraved and fastened to equipment with screws-
   A. Equipment mark noted on Drawings
   B. Area served
2. Symbols:
   1) Background Color- Provide by piping

Symbol	Name	Color
NG	Natural Gas	Yellow

NG	Natural Gas	Yellow
HW	Potable Hot Water	Green
CW	Potable Cold Water	Green
AIR	Air	Blue

3. Colored Plastic bands and arrows:
   1) Colored bands and arrows if installed on insulated piping shall be installed by attaching the colored identification label on the insulated pipe and wrapping the arrows completely around the pipe and stubing back on itself at each end of the identification label to prevent the labels from coming loose

END OF SECTION 22 0553

SECTION 22 0640 – SCHEDULES FOR PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Refer to Plumbing Fixture schedules on the drawings.
   1. All required waste, vent, water, and steam piping required will need to be connected to each device shown. All piping and valves in product area must be 316 S.S.
   2. All waste, vent, and water piping in area 1 shall be standard commercial grade piping and connections

END OF SECTION 22 0640

SECTION 22 0716 – PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 01 00 apply to this Section.

1.2 SUMMARY

A. Furnish and install plumbing insulation as described in Contract Documents including but not limited to the following:
   1. Water heater (Not factory insulated)
   2. Water storage tanks (Not factory insulated)
   3. Heat Exchanges
   4. Pumps

1.3 QUALITY ASSURANCE

A. Insulation shall have composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding: Flame Spread of 25 and Smoke Developed of 50.

B. Insulation Contractor shall certify in writing, prior to installation, that all products to be used will meet the above criteria.

C. Accessories, such as adhesives, mastics, cements, and tapes, for fittings shall have the same component ratings as listed above.

D. Products, or their shipping cartons, shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

E. Any treatment of jacket or facings to impart flame and smoke safety shall be permanent.

F. The use of water-soluble treatments is prohibited.

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 E 84, NFPA 255, OR UL 723.

2.2 GLASS FIBER, RIGID

A. Insulation: ASTM C 612 or ASTM C 592; rigid, noncombustible.
   1. K' Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C 177 or ASTM c 518.
   2. Maximum service temperature: 850 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.
   4. Maximum Density: 8.0 lb./cu ft.

B- Vapor Barrier Jacket:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 per inch, when tested in accordance with ASTM E 96/E 96M.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

2.3 JACKETS

A- Aluminum Jacket: ASTM B 209 (ASTM B 209M) formed aluminum sheet.
1. Thickness: 0.016-inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2-inch laps.
4. Metal Jacket Bands: 3/8-inch-wide; 0.015-inch-thick aluminum.
5. Metal Jacket Bands: 3/8-inch wide; 0.010- inch thick stainless steel.

B- Required in all product process area and boiler room.

PART 3- EXECUTION

3.1 EXAMINATION

a) Verify that equipment has been tested before applying insulation materials.
b) Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

a) Install in accordance with manufacturer's instructions.
b) Factory Insulated Equipment: Do not insulate
c) Exposed Equipment: Locate insulation and cover seams in least visible locations.
d) Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
e) Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
f) For hot equipment, insulate flanges and unions, but bevel and seal ends of insulation.
g) Inserts and Shields:
1. Application: Equipment 1-1/2 inches diameter or larger.
2. Shields: 316 S.S. between hangers and inserts.
3. Insert Location: between support shield and equipment and under the finish jacket.
4. Insert configuration: Minimum 6 inches ling, 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). Finish insulation at supports, protrusions, and interruptions.
i.) Equipment in Mechanical Equipment Rooms or finished Spaces: Finish with aluminum jacket.

END OF SECTION 220716

SECTION 22 0719 –PLUMBING PIPING INSULATION AND FIRE STOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 01 00 apply to this Section.

1.2 SUMMARY

A. Furnish and install mechanical insulation and fire stopping as described in Contract Documents including but not limited to the following:
   1. Cold Water and Rain Drain Piping Insulation
   2. Hot Water Piping Insulation (Domestic)
   3. Fire Stopping

B. Furnish and install insulation on underground hot and cold-water pipes within the confines of building as described in the contact documents.

C. Furnish and install insulation on above ground hot, hot recirculating, cold roof drain lines, fittings, valves, pump bodies, flanges and accessories as described in the content documents.

D. Furnish and install insulation on handicapped fixtures as described in contact documents.

E. Furnish and install fire stopping as described in contact documents.

1.3 QUALITY ASSURANCE

A. Insulation shall have composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding: Flame Spread of 25 and Smoke Developed of 50.

B. Insulation Contractor shall certify in writing, prior to installation, that all products to be used will meet the above criteria.

C. Accessories, such as adhesives, mastics, cements, and tapes, for fittings shall have the same component ratings as listed above.

D. Products, or their shipping cartons, shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

E. Any treatment of jacket or facings to impart flame and smoke safety shall be permanent.

F. The use of water-soluble treatments is prohibited.

G. Handicapped fixtures cover must meet federal standards for protection from burns and abrasions.

H. Fire stopping material shall meet ASTM E 814, E84 and be UL listed.

PART 2- PRODUCTS

2.1 POTABLE WATER INSULATION.

A. One-inch thick slap-on glass fiber pipe insulation

B. Heavy density pipe insulation with factory vapor jacket equal to Fiberglass ASJ may be used.

C. Approved Manufacturers:
   1. CTM
   2. Manville
   3. Owens-Corning
   4. Knauf

2.2 PVC FITTING, VALVE, & ACCESSORY COVERS.

A. Approved Manufacturers:
   1. Knauf
   2. Zeston
   3. Handicapped Fixtures:
      a. Install tamper-proof locking strip to discourage pilferage.
   4. Underground Insulation:
      a. Slip underground pipe insulation onto pipe and seal butt joints.
      b. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.
   5. ALUMINUM JACKET
      a. ASTM B 209 formed sheet.
      b. 0.016 inch sheet with smooth finish.
      c. 3/8 inch wide, 0.010 thick stainless steel bands.
      d. Required on all words in “Product process area” and boiler room.

2.3 FIRE STOPPING

A. Follow manufacturer’s installation instructions explicitly for rated partitions

B. Seal penetrations of ductwork, piping, and other mechanical equipment through one-hour and two-hour rated partitions as shown on Architectural and Mechanical drawings.

C. Install fire stopping material on clean surfaces to assure adherence.

PART 3- EXECUTION

3.1 POTABLE WATER INSULATION

A. Piping:

1. Apply insulation to clean, dry piping with joints tightly butted.

2. Adhere “factory applied vapor barrier jacket lap” smoothly ad securely at longitudinal laps with a white vapor barrier adhesive.

3. Adhere 3-inch-wide self-sealing butt joint strips over end joints.

B. Fittings, Valves, & Accessories:

1. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.

2. Cover insulation with one-piece fitting cover secured by stapling or taping ends to adjacent pipe covering.

C. Pipe Hangers:

1. Do not allow pipes to come in contact with hangers.

2. Provide 16 ga X 6-inch-long stainless steel shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.

3.2 RAIN DRAINS

A. A. Insulate rain drain lines, overflow lines, and drain bodies.

B. B. Seal off vapor barrier to pipe at all fittings, hangers, and every 20 feet on straight runs.

3.3 ROOF DRAIN PIPING

A. ½ Inch thick pre-formed fibrous glass pipe covering with a vapor barrier jacket or ½ Inch thick rubber insulator.

B. End joint strips and overlap seams shall be adhered with a vapor barrier mastic and stapled with outward clinch staples on 4-inch centers. Staples and seam shall be sealed with a second coat of vapor barrier adhesive.

3.4 HANDICAPPED FIXTURE

A. Insulating device shall be molded fire-resistant foam, to encapsulate hot water piping, stop, and P-trap.

1. Approved Manufacturers:

a. TCI Products' Skal+Gard SG-100B

B. Safety cover with reclose able sealing strips which allow for removal and replacement for line maintenance may be used on drain and supply lines under lavatories.

1. Approved Manufacturers
   a. Handy-Shield
   b. Plumberex

C. Color Shall be white.

3.5 UNDERGROUND

A. Insulation:
   1. ½-inch thick Armaflex Standard Pipe Insulation
   2. Equal by Rubatex
   3. Equal by Imcolock
B. Joint Sealant:
   1. Armstrong 520

3.6 FIRE STOPPING

A. Material shall be flexible, long lasting, intumescent acrylic seal to accommodate vibration and building movement.

B. Caulk simple penetrations with gaps of ¼-inch or less with:
   1. Dow Corning Fire Stop Sealant
   2. Pensil 300

C. Caulk multiple penetrations and/or penetrations with gaps in excess of ¼-inch thick with:
   1. Dow Corning Fire Stop Foam
   2. Pensil 200
   3. IPC flame safe FS-1900
   4. Tremco "Tremstop 1A"

END OF SECTION 22 0719

SECTION 22 1114-- NATURAL GAS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install gas piping and fittings within building including connection to meter.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Welders shall be certified and bear evidence of certification 30 days prior to commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

PART 2 - PRODUCTS

2.1 PIPE

A. Meet requirements of ASTM A 53-89a, "Specification for Pipe, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".

B. Carbon steel, butt welded, Schedule 40 black steel pipe.

2.2 FITTINGS

A. Black Pipe:
   1. Welded forged steel fittings meeting requirements of ASTM A 234-89a, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures", or standard weight malleable iron screwed.

2.3 VALVES

A. 125 psi bronze body ball valve, UL listed

B. Approved Manufacturers & Models:
   1. ConBraCo - "Apollo" series 80-100
   2. Jenkins - FIG-30-A
   3. Jomar - Model T-204
   4. McDonald - 3410
   5. PGL Corp - "Red Cap" gas ball valve
   6. Watts - Model B-6000-UL

2.4 PRESSURE REDUCING REGULATORS

A. Self- operated, spring loaded regulator with large diaphragm area.

B. Internal registration and relief.

C. Tamper-resistant adjustment with corrosion resistance brass for indoor or outdoor use.

D. ½″ to 1 ½ ″ Threaded NPT.

E. 2″ and Above Flanged.

F. Max Inlet Pressure 5 psi., Max Outlet Pressure 0.5 psi.

G. Temperature Capabilities - ~20 to 180° F.

H. Install with manual shut off cock.

I. Approved Manufactures and Models.
   1. Emerson Y600 AR.
   2. Maxitrol 3UP33.
   3. Or Approved Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pipe installed underground, through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other pipe may have screwed or welded fittings.

B. Wrap and lay underground pipe in accordance with local gas utility company regulations and specifications.

C. Install gas cocks on lines serving boilers, furnaces, duct heaters, rooftop equipment, and water heaters adjacent to boiler, furnace, or heater on outside of boiler, furnace, or heater cabinet and easily accessible.

D. Do not use flexible pipe connections to boilers, furnaces, duct heaters, or hot water heaters unless approved by engineer. Check equipment installation information.

E. Install dirt leg with pipe cap, 6 inches long minimum, on each vertical gas drop to heating equipment.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Paint all exterior exposed gas piping, including rooftop piping with gray paint to match gas meter.

H. Support rooftop piping with standard manufactured supports designed to support the gas piping on the roof of the building, and connect to roof mounted gas line equipment

END OF SECTION 22 1114

SECTION 22 1116 – POTABLE WATER PIPING SYSTEMS (STAINLESS STEEL)

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install potable water piping complete with necessary valves, connections, and accessories serving the product area inside building and connect with main service inside boiler room.

1.3 SUBMITTALS

A. Quality Control:
1. Submit written report of sterilization test to Architect.

PART 2 -PRODUCTS

2.1 PIPE

A. Schedule 40 316 stainless steel pipe and fittings rated at 500 psi.

2.2 FITTINGS

A. 316 stainless steel schedule 40.

2.3 CONNECTIONS:

A. Welded stainless steel joints

B. Do not use a plain steel wire brush for cleaning the piping or fittings

C. Use special equipment and tools for working on the stainless steel.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Install piping under slabs without joints where possible.

B. Locate cold water lines a minimum of 6 inches from hot water line.

C. Run main water pipe and branches to all fixtures.

D. Size piping as shown.

E. Run piping direct and concealed from view, unless otherwise shown.

F. Grade horizontal runs to allow for drainage.

G. Provide sufficient drains to draw water from entire domestic water system and sections thereof where cutoffs are shown.

H. Furnish and install complete hot and/or cold water to all fixtures and equipment as shown on drawings.

I. Run lines parallel to each other and parallel with the lines of the building.

J. Cut pipes accurately to required measurements and work into place without springing or forcing.

K. Provide for expansion and contraction of piping.

3.2 FIELD QUALITY CONTROL

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

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

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

D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION 22 1116

SECTION 22 1117 – POTABLE WATER PIPING SYSTEMS (COPPER)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with main service inside boiler room.

B. Perform excavating and backfilling required by work of this Section.

1.3 SUBMITTALS

A. Quality Control:
1. Submit written report of sterilization test to Architect.

PART 2 - PRODUCTS

2.1 PIPE

A. Type K copper for piping underground or beneath concrete slab. 3/4 inch minimum under slabs.

B. Type L hard drawn copper for above ground applications.

2.2 FITTINGS

A. Wrought copper.

2.3 CONNECTIONS:

A. Sweat copper type with 95/5 or 96/4 Tin-Antimony solder. Victaulic copper connection system with “FS” flush-seal gasket and zero-flex couplings.

B. Joints under slabs, if allowed by local codes, shall be brazed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping under slabs without joints where possible.

B. Locate cold water lines a minimum of 6 inches from hot water line.

C. Run main water pipe and branches to all fixtures.

D. Size piping as shown.

E. Run piping direct and concealed from view, unless otherwise shown.

F. Grade horizontal runs to allow for drainage.

G. Provide sufficient drains to draw water from entire domestic water system and sections thereof where cutoffs are shown.

H. Furnish and install complete hot and/or cold water to all fixtures as shown on drawings.

I. Run lines parallel to each other and parallel with the lines of the building.

J. Cut pipes accurately to required measurements and work into place without springing or forcing.

K. Provide for expansion and contraction of piping.

L. Paint exposed threads on underground piping one coat asphaltum varnish.

3.2 FIELD QUALITY CONTROL

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

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

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

D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION 22 1117

SECTION 22 1118 – AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install air piping complete with necessary valves, connections, and accessories inside building and connect with air compressor inside the boiler room.

B. Perform excavating and backfilling required by work of this Section.

1.3 SUBMITTALS

A. Quality Control:
1. Submit written report of pressure and cleaning test to Architect.

PART 2 - PRODUCTS

2.1 PIPE

A. 316 stainless steel pipe from compressor to process equipment.

2.2 FITTINGS

A. 316 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Run air pipe and branches to all process equipment.

B. Size piping as shown.

C. Run piping direct and concealed from view, unless otherwise shown.

D. Grade horizontal runs to allow for drainage.

E. Provide sufficient drains to draw water from entire domestic water system and sections thereof where cutoffs are shown.

F. Cut pipes accurately to required measurements and work into place without springing or forcing.

3.2 FIELD QUALITY CONTROL

A. Before pipes are covered, test systems in presence of Architect at 150 psi hydrostatic pressure for two hours and show no leaks.

B. Clean and flush all air piping to remove debris.

END OF SECTION 22 1118

SECTION 22 1131 – EQUIPMENT CONNECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install materials and labor necessary to make all required air steam, hot water, cold water, waste, and vent rough-ins and to make all final connections for equipment as described in Contract Documents.

B. Processing equipment, unless specifically noted otherwise, shall be furnished and connected by Process Equipment Contractor.

C. Equipment Contractor shall provide complete roughing-in drawings showing exact location of stub-ups in floor and in walls. It will be Plumbing Contractor's responsibility to install all sleeves through walls and floor and to connect all plumbing services. Floors shall be core drilled. Plumbing Contractor shall request this roughing-in information well in advance of installation of equipment.

D. Each hot water, cold water, and air steam connection to equipment shall include a valve and union and shall be capped for connection after equipment has been installed.

E. Pipe sleeves shall be installed where piping rises through floors and shall be caulked with waterproof compound.

F. Equipment Contractor shall provide and install all equipment, including water and steam waste, connections.

G. Plumbing Contractor shall provide cold water and hot water services, steam, air services with S.S. shut off valves and steel outs for connection by the process equipment contractor.

END OF SECTION 22 1131

SECTION 22 1140 - CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install condensate drain piping as described in Contract Documents.

B. Related Requirements:
1. Section 23 0100: Common HVAC Requirements.
2. Section 22 0100 Common Plumbing Requirements.

1.2 REFERENCES

A. Reference Standards:
1. ASTM International:
a. ASTM B 88-03, 'Standard Specification for Seamless Copper Water Tube.'

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Materials:
1. Condensate Drains:
a. Schedule 40 PVC for condensate drains from combustion chambers and cooling coils, and auxiliary drain pans.

B. Manufactured Units
1. Condensate Pump
a. Rated at 225 gph at 15 feet total head. Complete with one gallon polystyrene tank with pump and automatic float control. 1/5 hp, 120 V, one phase, 60 Hertz.
b. Condensate piping shall be Type M copper or Schedule 40 PVC.
c. Approved Manufacturers -
1) No. CU551UL by Beckett Pumps, (888) 232-5388
2) No. VCL45S by Little Giant Pump Co, Oklahoma City, OK (405) 947-2511

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains:
1. Support piping and protect from damage.
2. Do not combine PVC condensate drain piping from combustion chamber with copper condensate drain piping from cooling coil.
3. Do not combine auxiliary drain pan piping with furnace / Cooling Coil Condensate drain piping.

END OF SECTION 22 1140

SECTION 22 1316 – SOIL, WASTE, & VENT PIPING SYSTEMS (PROCESS AREA STAINLES STEEL)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 01 00 apply to this Section.

1.2 SUMMARY

A. Furnish and install soil, waste, and vent piping systems within the process area of the building and connect with outside utility lines 5 feet out from building where applicable.

B. Perform excavation and backfill required by work of this Section.

C. Minimum 2-4 inch leveling course of sand is required around all buried piping

PART 2 - PRODUCTS

2.1 BURIED LINES

A. Josam 316 S.S. push-fit pipe and fitting, waste, drain, and vent system.

B. Meet requirements of ASME A112.3.1-2007, IGC 275-10 and IAPMO listed.

C. Install according to all manufacturing requirements.

2.2 ABOVE GRADE PIPING & VENT LINES

A. Same as specified for buried lines.

B. Provide all required S.S. supports and hangers.

2.3 TRAP PRIMERS

A. Components:
   1. Drains And Drain Accessories:
      a. Floor Drain
         1) Approved types with deep seal trap and chrome plated strainer.
         2) Provide trap primer connection and trap primer equal to Sioux Chief 695-01.
         3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Josam: All 316 stainless steel to fit with Josam “push-fit”. 316 S.S. waste piping system.

2.4 PRECISION TRAP PRIMERS:

a. Provide and install Precision Plumbing Products “prime-time” (or approved equal) trap priming assembly.
b. Complete assembly including:
   1) Atmospheric vacuum breaker.
   2) Pre-set 24 hour clock.
   3) Manual over-ride switch.
   4) 120v/220v solenoid valve.
   5) ¾” FNPT connection with isolation valve.
   6) Calibrated manifold for equal water distribution.
   7) 5/8” outlet compression fittings (for ½” Pex piping connections).
   8) Manifold outlets as specified on plans.
   9) 12”x12”x4” Nema 1 metal cabinet with cover plate for surface mounting.
c. Operation:

1) Priming assembly will supply a minimum of 20 oz. of potable water at 20 psig at a preset factory setting of 10 seconds.
2) The entire unit is pre-assembled in a steel cabinet for surface mounting.
3) The priming assembly must be mounted above the finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Slope horizontal pipe at 1/4 in/ft.

B. Cleanouts:
1. Provide and set full size cleanouts at foot of each riser, and ends of branches at points where a change of direction occurs, on exposed and accessible traps, at points where required to remove rust accumulation or other obstructions and as shown on plans. Set screw cap in cleanout with graphite paste. Cleanouts in walls shall be flush and covered with a stainless steel cleanout cover screwed into the cleanout plug. Cleanouts in floors shall be flush using Josam floor level S.S. cleanout fittings. Location of all cleanouts subject to approval of inspector.

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

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

E. Use Josam push-fit joint system with FPM gaskets.

F. Flash pipes passing through roof with 16 oz sheet copper flashing fitted snugly around pipes and calk between flashing and pipe with flexible waterproof compound. Flashing base shall be at least 24 inches square.

3.2 FIELD QUALITY CONTROL

A. Before piping is covered, conduct tests for leaks and defective work. Notify Architect prior to testing. Correct leaks and defective work. Fill waste and vent system to roof level with water, 10 feet minimum, and show no leaks for two hours.

END OF SECTION 22 1316

SECTION 22 1317 – SOIL, WASTE, & VENT PIPING SYSTEMS (NON-PROCESS AREA)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 01 00 apply to this Section.

1.2 SUMMARY

A. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building where applicable.

B. Perform excavation and backfill required by work of this Section.

PART 2 - PRODUCTS

2.1 BURIED LINES

A. Service weight, single-hub type cast iron soil pipe and fittings meeting requirements of ASTM A 74-87, "Specification for Cast Iron Soil Pipe & Fittings".
   1. Joint Material:
      a. Rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
      b. No hub stainless steel clamps with neoprene gasket.

B. ABS-DWV or PVC-DWV plastic waste pipe and fittings as permitted by state and local plumbing code.

2.2 ABOVE GRADE PIPING & VENT LINES

A. Same as specified for buried lines except no-hub pipe may be used.

B. Vent lines 2-1/2 inches or smaller may be Schedule 40 galvanized steel.

C. Joint Material:
   1. Bell & Spigot Pipe - rubber gaskets meeting requirements of ASTM C 564-88, "Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
   2. No-Hub Pipe - Neoprene gaskets with stainless steel cinch bands.
   3. Galvanized Pipe - Screwed Durham tarred drainage fittings, or Victaulic.
   4. ABS-DWV solvent weld fittings

2.3 TRAP PRIMERS

A. Components:
   1. Drains And Drain Accessories:
      a. Floor Drain FD-1:
         1) Approved types with deep seal trap and chrome plated strainer.
         2) Provide trap primer connection and trap primer equal to Sioux Chief 695-01.
         3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Josam: 30000-50-Z-5A.
            b) J. R. Smith: 2010-A.
            c) Sioux Chief: 832.
            d) Wade: 1100.
            e) Watts: FD-200-A.
            f) Zurn: Z-415.

2.4 PRECISION TRAP PRIMERS:

a. Provide and install Precision Plumbing Products “prime-time” (or approved equal) trap priming assembly.
b. Complete assembly including:
    1) Atmospheric vacuum breaker.
    2) Pre-set 24 hour clock.
    3) Manual over-ride switch.
    4) 120v/220v solenoid valve.
    5) ¾” FNPT connection with isolation valve.
    6) Calibrated manifold for equal water distribution.
    7) 5/8” outlet compression fittings (for ½” Pex piping connections).
    8) Manifold outlets as specified on plans.
    9) 12”x12”x4” Nema 1 metal cabinet with cover plate for surface mounting.
c. Operation:
    1) Priming assembly will supply a minimum of 20 oz. of potable water at 20 psig at a preset factory setting of 10 seconds.
    2) The entire unit is pre-assembled in a steel cabinet for surface mounting.
    3) The priming assembly must be mounted above the finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not caulk threaded work.

B. Slope horizontal pipe at 1/4 in/ft.

C. Cleanouts:
1. Provide and set full size cleanouts at foot of each riser, and ends of branches from toilets, at points where a change of direction occurs, on exposed and accessible traps, at points where required to remove rust accumulation or other obstructions and as shown on plans. Set screw cap in cleanout with graphite paste. Cleanouts in walls shall be flush and covered with a chrome plated cleanout cover screwed into the cleanout plug. Cleanouts in floors shall be flush using Zurn, Josam, or Wade floor level cleanout fittings. Location of all cleanouts subject to approval of inspector.

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

E. Vent entire waste system to atmosphere. Discharge 14 inches above roof. Join lines together in fewest practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley.

F. Use torque wrench to obtain proper tension in cinch bands when using hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

G. Flash pipes passing through roof with 16 oz sheet copper flashing fitted snugly around pipes and calk between flashing and pipe with flexible waterproof compound. Flashing base shall be at least 24 inches square.

3.2 FIELD QUALITY CONTROL

A. Before piping is covered, conduct tests for leaks and defective work. Notify Architect prior to testing. Correct leaks and defective work. Fill waste and vent system to roof level with water, 10 feet minimum, and show no leaks for two hours.

END OF SECTION 22 1317

SECTION 22 1329 – SEWAGE EJECTOR PUMP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 01 00 apply to this Section.

B. See fixture schedule on drawings.

1.2 SUMMARY

A. Furnish and install a sewage ejector pump as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Duplex Sewage Pump:
   1. Submersible type with recessed impeller to give complete unobstructed volute opening for passing of solids.
   2. Pump shall pass 2" diameter solids.
   3. Discharge of pump shall be provided with bolt on flange, check valve and gate valve.

B. Pump Motor:
   1. Submersible type with ratings as indicated on schedule.
   2. Single phase motors shall be of permanent split capacitor type with no relays or starting switches.
   3. Motor shaft shall be of 416 stainless steel and shall be heat shrunk into die cast motor.
   4. Rotor shaft shall be supported by a lower ball bearing to take thrust and radial loads and by an upper bronze sleeve bearing to take radial loads only.
   5. Single phase motors shall have an overload element embedded in winding to protect motor against over current and overheating conditions. Overload element shall automatically reset when motor cools.

C. Sump level control shall be controlled by sealed control. Switch shall have three displacement plastic weights mounted on corrosion proof cable and to be adjustable for pump-off levels required and high water alarm.

D. Duplex control box shall be Nema 1 enclosure and shall include the following controls:
   1. Main circuit breakers
   2. Magnetic contactor for each pump controlled
   3. Over current heaters
   4. Alternating relay
   5. Over ride relay
   6. Alarm relay
   7. H-O-A switches
   8. Alarm switch
   9. Run and alarm lights
   10. Overload reset buttons

E. Sump:
   1. Size as sown on drawings.
   2. Fiberglass basin with gas tight steel cover, epoxy coated.
   3. Seal cover to basin with caulking compound.

END OF SECTION 22 1329

SECTION 22 1416 – RAIN WATER LEADERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. This Section includes storm-drainage piping inside the building and to locations indicated.

B. Related Sections include the following:
1. Division 22 Section 0719 For roof water leader pipe insulation..

1.3 PERFORMANCE REQUIREMENTS
1. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
2. Storm Drainage Piping: 10-foot head of water.

1.4 SUBMITTALS
1. Product Data: For pipe, tube, fittings, and couplings.
2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE
1. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 ROOF DRAIN PIPING
a. Above Grade: Up to 3"- Josam "push-fit" 316 stainless steel pipe and fittings with FPM gaskets
b. Below Grade: And Larger than 3"Josam "push-fit" 316 stainless steel pipe and fittings with FPM gaskets.
c. Under ground piping shall be bedded in Sandfill all around.

2.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

2.3 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers.

B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight.

C. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
1. Building Storm Drain: 1 percent downward in direction of flow for piping.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

2.4 HANGER AND SUPPORT INSTALLATION

A. "Hangers and Supports" install the following:
   1. Vertical Piping: Stainless steel clamps
   2. Individual, Straight, Horizontal Piping Runs: Stainless steel clevis and S.S. rods.

2.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

2.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   5. Prepare reports for tests and required corrective action.

2.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 1416

SECTION 22 1519- GENERAL SERVICE PACKAGED AIR COMPRESSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install general service packaged air compressors.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacture qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
   2. Pressure Vessels: Conform to applicable code for installation of pressure vessels.
   3. Products requiring Electrical Connection: Listed and classified by underwriters laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 AIR COMPRESSOR

A. Manufacturers:
   1. Quincy QGD-40

B. Type: Simplex compressor unit consisting of air-cooled compressor, air receiver, after cooler, refrigerated air dryer.

C. Compressors:
   1. Unit: Rotary screw compressor with positive displacement oil pump lubrication system, suction inlet screen, discharge service valves on welded steel base for motor and compressor.
   2. Automatic capacity reduction.
   3. Motor: Fixed speed drive
   4. Controls:
      a. Control Panel: Factory wired, steel, containing power and control wiring, molded case disconnect switch, factory wire for single point power connection.
      b. Starter: Full with manual reset current overload protection, starter relay, control power transformer, terminal strip for connection to interface equipment.
      c. Safety Controls: Manually reset low oil pressure cutout.
      d. Automatic restart after power failure
      e. Dual pressure set point
      f. GRA air logic controller
   5. The package shall be enclosed in a accessible sound cabinet.

2.2 AFTERCOOLER

A. Manufacturers:
   1. Quincy

B. Construction: Removable tube bests of non-ferrous metal tubes and corrosion resistant tube plates, safety valves, pressure gage, moisture separator, moisture drain valve, water inlet piping with automatic water valve, automatic condensate trap and overflow piping with open funnel.

2.3 AIR DRYER

A. Manufacturers:
1. Quincy

B. Type: Self Contained mechanical refrigeration type compete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and fill refrigerant charge.

C. Air Connections: Inlet and outlet connections at same level, factory insulated.

D. Heat exchangers: Air to air and refrigerant to air coils. Provide heat exchangers with automatic control system to bypass refrigeration system on low or no load condition.

E. Moisture Separator: Centrifugal type located at discharge of heat exchanger.

F. Refrigeration unit: Hermetically sealed type to operate continuously to maintain specified dew point. House unit in steel cabinet provided with access door and panel for maintenance and inspection.

G. Accessories: Air inlet temperature gage, air inlet pressure gage, on/off switch, high temperature light, power on light, refrigerant gage, air outlet temperature gage, air outlet pressure gage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.
B. Install compressor unit on vibration isolators. Level and bolt in place.
C. Make air cock and drain connection on horizontal casing.
D. Install line size gate valve and check valve on compressor discharge.
E. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.
F. Connect condensate drains to nearest floor drain.
G. Install valves bypass around air dryer. Factory insulate inlet and outlet connections.
H. Install takeoffs to outlets from top of main, with shut off valve after take-off. Slope take off piping to outlets.
I. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated.
J. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
K. Install complete with recommended wet filter, wet receiver, in line filters before and after air dryer and dry storage tank and other accessories required by equipment manufacturer.

END OF SECTION 22 1519

SECTION 22 3420 – GAS FIRED STORAGE TYPE WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install water heater as described in Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Glass lined storage tank, pressure tested and rated for 150 psi wp complete with thermostat, high limit control, gas valve, gas pressure regulator, 100% safety shut-off, and draft diverter. AGA approved.

B. 100 Gallon:
   1. With hand hole cleanout and non-prorated three year tank warranty.
   2. Approved Manufacturers:
      a. BTH-199 by A O Smith with sealed combustion chamber
      b. State Industries

2.2 ACCESSORIES

A. Anchoring Components:
   1. One inch by 18 ga galvanized steel straps.
   2. No. 10 by 2-1/2 inch screws.

B. Thermal Expansion Absorbers:
   1. Bladder type for use with potable water systems.
   2. Acceptable Products:
      a. Therm-X-Trol ST-12 by Amtrol.
      b. Equal as approved by Architect before bidding. See Section 01600.

C. Mixing Valve:
   1. Symmons T-700
   2. Solid brass construction and CSA B125 certified.
   3. Includes integral check valves and inlet screen. Features advanced paraffin-based actuation technology.
   4. Flow of 5.7 GPM with maximum 10 psi (69 kPA) pressure drop. Perform to minimum flow of 0.5 GPM (1.89 LPM) in accordance with ASSE 1016 and 1070.
   5. Set for 110 deg F (43 deg C) Service.
   6. Acceptable Manufacturers: Leonard, Powers, Sloan, and Watts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Water heaters shall each have temperature-pressure relief valve sized to match heat input and set to relieve at 120 psi.

B. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor drain.

3.2 WATER TEMPERATURE

A. Contractor shall be responsible to verify and/or change temperature settings on water heaters supplied on this project to meet requirements of Life Safety and Health Department Codes. Any setting above 120 deg. F. shall require warning labels placed on outside of water heaters in conspicuous places indicating water temperature setting and fact that any temperature above 120 deg. F. may be a hazard.

END OF SECTION 22 3420

SECTION 22 3450 - FLUES FOR WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install heating equipment exhaust piping and combustion air intake piping as described in Contract Documents.

B. Related Sections:
   1. Sections Under 09 9000 Heading: Painting.
   2. Section 22 0100: Common Plumbing Requirements.
   3. Section 23 0100 Common HVAC Requirements.

1.2 REFERENCES

A. American Society For Testing And Materials:
   1. ASTM D 1785-03, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120.'
   2. ASTM D 2564-02, 'Standard Specification for Solvent Cements for Poly(Vinyl Chloride)(PVC) Plastic Piping Systems.'
   3. ASTM D 2661-02, 'Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings.'
   4. ASTM D 2665-02, 'Standard Specification for Poly(Vinyl Chloride)(PVC) Plastic DWV Pipe Fittings.'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Air Piping: Schedule 40 pipe and fittings requirements of ASTM D 1785, 2661, or 2665.

B. Piping Primer And Cement: Meet requirements of ASTM D 2564.

2.2 MANUFACTURERS

A. Contact Information:
   1. Armaflex by Armacell, Mebane, NC www.armaflex.com.
   2. Nomaco K-Flex, Youngsville, NC www.nomacokflex.com.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation For Condensing Water Heaters:
   1. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
   2. Slope combustion chamber exhaust drain downward to floor drain.

B. Support:
   1. Support concentric roof termination at ceiling or roof line with 20 ga metal straps as detailed.
   2. Support horizontal sections of pipe in accordance with requirements of Section 23 0501. Anchor securely to structure, not allowing pipe to sway.

END OF SECTION 22 3450

SECTION 22 4360 – GAS FIRED DIRECT CONTACT HEATER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Specification covers the requirements for furnishing and delivering 3 gas fired direct contactwater heaters.

B. This Specification also covers the requirements for the design, fabrication, testing and inspectionsprior to shipment.

C. In addition, this Specification describes information to be included with the Proposal, as well as requirements by the Vendor after the award of order.

1.2 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.
   1. Quote to provide heater information indicating stack connection sizing and heater footprint..

B. Water supply performance: Submit available hot water performance based on the following minimum and maximum design flow and pressure conditions.

PROJECT	MEDIUM WATER TEMPERATURE PROJECT	HIGH WATER TEMPERATURE PROJECT
Site Elevation	5000 Feet ASL	5000 Feet ASL
Required Hot Water:		
Flow	150gpm	123gpm
Pressure	45psig	30psig
Temperature	110°F	180°F
Water Inlet Condition		
Min Pressure	19psig	26psig
Min Temperature	50°F	50°F
Fuel Gas Supply		
Gas Supply	Natural Gas	Natural Gas
Pressure	14” W.C. - 42” W.C.	1.5psig – 4.0psig
Temperature	60°F	60°F

C. Shop Drawings: For heater, heater trim and accessories include:
   1. Plans, elevations, details and attachments to other work
   2. Process Flow Diagram
   3. Wiring Diagrams for power, signal and control wiring

D. Source Quality Control Test Reports (Section 2.09): Reports shall be included in submittals.

E. Field Quality Control Test Reports (Section 3.03): Reports shall be included in submittals.

F. Operation and Maintenance Data: Data to be included in heater normal operation and maintenance manuals.

G. Warranty: Standard warranty specified in this Section

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Heater components must be listed and labeledas defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Heater functional acceptance test (FAT) will be conducted in accordance with manufacturers standard testing practice to include the items below. Customer witnessed FAT is available uponrequest.
   a. Review of all quality documents
   b. Inspection and testing of heater control panel.
   c. Gas train leak inspection
   d. Testing of all control safety strings for fuel gas, burner and heater.
   e. Calibration of burner emissions throughout the burner operating range
   f. Functional operation of burner, heater and water pump system

C. Heater combustion emissions will meet the following corrected to 3% oxygen standard at all firingrates for Natural Gas:
   a. CO: 50ppm Maximum
   b. NOx: 100ppm Maximum

D. The latest edition of the following standards, codes and specifications shall, to the extent herein,form a part of this specification:
   a. ASME CSD-1 for Burner Gas Train
   b. NFPA 70 (NEC)
   c. AGA Z21.13 / CSA4.9 Gas fired low-pressure steam and hot water boilers
   d. NFPA 54 (AGA Z223.1) – National Fuel Gas Code
   e. UL508A – Control Panels

1.4 COORDINATION

A. The heater interconnection and mounting size and location of the following will be provided fromthe heater manufacturer to the purchaser:
   a. Mechanical interconnection location, size and connection rating/type for the
      i. Natural Gas Supply
      ii. Water Supply
      iii. Water Discharge
   b. Electrical interconnection for power and controls
   c. Coordination of the heater base plate size, heater weight and anchor points. Note design ofconcrete pads and foundation to support the heater is to be provided by Customer.

1.5 WARRANTY

A. Standard Warranty: Heater manufacturer shall guarantee the heater and its components it manufactures, to be free from defective materials and workmanship for a period of eighteen (18) months from notification that the goods are ready to be shipped or twelve (12) months from start-up, whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. This specification is based on the QuikWater, Flagship series direct contact heater as manufactured by OGI Process Equipment Inc. Equivalent units and manufacturers must meet allperformance criteria and will be considered.

2.2 CONSTRUCTION

A. Description: Heater shall be natural gas fired, direct contact water heater. Power burner shall have full modulation, firing into a water-cooled combustion chamber and discharging into watercooled packing bed.

B. This direct contact water heaters shall be a factory designed, fabricated, assembled, tested andinspected as a complete assembly.

C. Customer mechanical interconnection will be provided as follows:
   1. Customers water supply connection, water supply pressure, temperature and flow per the performance requirements stated above.
   2. Hot water discharge pump and connection,
   3. Burner fuel gas supply connection,
   4. Hot water tank drains
   5. Heater combustion chamber stack connection, size per attached Heater Specification Sheet
   6. Heater combustion chamber stack combustion analyzer connection.

D. Customer controls and electrical connections will be provided as follows:
   1. A single 3-phase power connection for Burner / circulating water pump power. Power distribution within the heater with individual motor controls and motor protection. A step- down transformer and low voltage power supplies will be supplied with the heater packagefor 120Vac/1/60 and 24Vdc heater controls.
      i Customer to provide overcurrent protection and a lockable, disconnecting means toisolate and protect the heater for the incoming power.
      ii Maximum current Interruption capacity of the system design will be as follows:
         1 Burner and Pump Primary Power: 5kAIC
         2 Control Power: 5kAIC

E. All materials making up the heater's combustion chamber, heat transfer (upper) tower, integraltank and base plate will be constructed out of stainless-steel plate no less than 3/16" thick. Thickness will vary with heater size and configuration to properly support the heater assembly.The stainless-steel type and grade will be dependent on the water quality, below.
   1. 304SST for Chloride concentration <20ppm at 160°F maximum – 304SST
   2. 316SST for Chloride concentration >20ppm and < 75ppm at 160°F maximum
   3. 2205 SST for Chloride concentration >75ppm at 160°F maximum

F. Heat transfer packing material will be constructed of SST and develop no more than 0.5"W.C. back pressure when the burners is operating at its highest output and with the heater operating isat its highest demand.

G. Heater's heat transfer (upper) tower, and tank design will be self-supporting off of the tank orlower tower base plate. Support for the heater's combustion chamber will be provided off theheater surge tank or from grade using a separate chamber support, shipped loose with the heater.

H. Heater Water Circulating Control: Appropriate controls and instrumentation must be provided toensure cooling water flow and water level are provided prior to operation of heater burner and heater recirculation and transfer pumps.

I. Fuel gas train will be designed and manufactured per ASME CSD-1.

J. The heater combustion chamber and heat transfer tower must operate at approximately 1" W.C.above atmospheric pressure, or less.

K. Water circulating pump, piping and combustion chamber cooling water distribution system to properly cool the combustion chamber, heat transfer (upper) tower and remove the heat to meetthe desired heat transfer load and efficiency.

1. Heater's water tank design shall be such that it minimizes turbulence to the pump suctionand provides even distribution of heated water to the transfer pump suction.

L. Transfer and Recirculating water pump construction will be as follows:
1. Cast Iron case with a Bronze or SST impeller
2. Motors will be TEFC and will direct coupled to the pump case.
3. Pump will be directly mounted to the heater's tank wall with integral bypass to avoid dead-heading the pump and provide reliable pump priming.

M. The heater water connections shall be dependent on the heater capacity, as listed below.
1. Water inlet and outlet connections will be NPT.
i Water inlet will be connected to the water inlet isolation valve.
ii Water outlet will be connected to the Transfer Pump discharge connection.

HEATER CAPACITY	WATER INLET	WATER OUTLET
1 - 5 MMBTU	2 1/2" FNPT	2" FNPT
5.5 - 8 MMBTU	2 1/2" FNPT	3" FNPT

2. Heater water piping and fitting will be 304SST schedule 40, butt weld construction. 150# RF flange connections will be used for installation of valves and pumps integral tothe heater piping and to ease disassembly of removable sections of the heater.

N. Heater water piping must be designed with an MAWP of 125psig at 180°F and meet the follows:
1. Water inlet piping must be designed to support water inlet pressure and flow.
i Customer will provide water pressure regulation and over pressure protectionas necessary to ensure minimum pressure is provide at rated flow rate and heater inlet piping MAWP is not exceeded.
ii Customer will also provide water inlet isolation and filtration.
2. Water outlet piping must be designed to support transfer pump outlet pressure andflow.
3. Heater integral recirculating water piping must be designed to properly support recirculating water pressure and flow to ensure proper distribution of water to the combustion chamber, and heat transfer towers upper and lower cooling nozzle.

O. The heater's hot water delivery flow and pressure must meet the design conditions specified in section 1.02 of this specification above and is provided through a hot water transfer pump. TheTransfer pump trim will include:
1. a minimum flow bypass orifice and piping
2. discharge pressure and temperature gauge
3. OPTIONAL: Transfer pump discharge pressure control will be provided through a variable frequency drive controlled by the Heater Control Panel, monitored by a pressure transmitter located on the discharge of the pump.

P. Minimum heater efficiencies shall be as follows based on a 10°F delta-T above incoming water temperature. Efficiencies are based on 100% water demand rate and heater not operating in recirculation mode:

Q.

Exhaust Gas Temp	100% Demand	Exhaust Gas Temp	100% Demand
70 °F	99%	110 °F	95%
80 °F	98%	120 °F	93%
90 °F	97%	130 °F	91%

100 °F	96%	140 °F	88%

R. Stack Exhaust: The exhaust stack shall be of corrosion resistant, 304 stainless steel with thefollowing diameter flue connections:

HEATER CAPACITY	STACK O.D.
1 - 5 MMBTU	22”
5.5 - 8 MMBTU	28”

1. The exhaust manifold shall include a demisting pad to minimize condensate carryoverin the heater flue gases to the exhaust stack.
2. Customer supplied, stainless steel exhaust stack will designed to allow any condensateformed in the exhaust stack to drain back into the heater.

S. Burner: Will be a MAXON Ovenpak Series 400, packaged burner includes a combustion air blower with non-sparking paddle wheel-type impeller, pilot, spark ignitor, stainless steel dischargesleeve, mixing cone, self-contained internal air proportioning shutter, and connection for external mounted UV scanner. Burner fuel flow valve will be installed in the fuel gas piping near the burnermain gas inlet.

1. The burner shall not operate above 7.5% oxygen level or 55% excess air. The burner shall produce less than 80 ppm of NOx and 50ppm of CO, under standard calibration, corrected to 3% excess oxygen when firing on natural gas. Packaged nozzle-mixing gas burner as described below, with spark or proven pilot ignition. The Air and Fuel valves will modulate independently through a linkage-less ratio control system driven from the heaters burner management system (BMS). The burner Air / Fuel ratio will beadjustable throughout the firing rate of the burner to maintain the required burner emissions.
2. Blower: The heater shall operate during the burner firing sequence, pre-purge, and post-purge the combustion chamber. Burner blower can be external if necessary forlarger capacity heater’s. For External blowers:
    i. Blower and motor assembly will be supplied as a single integral unit on its own pedestal base to be secured to the same concrete foundation as the heater.
    ii. Blower will be located directly below the burner air supply.
    iii. Blower wheel will be constructed of aluminum, balanced, and directly mounted toits drive motor shaft.
    iv. Motor will be foot mounted.
    v. Motor and blower flywheel will be balanced as one assembly.
    vi. Blower discharge will be supplied with transition duct to converge the blower discharge to the size of the burner inlet.
    vii. Blower and burner vibration isolation will be provided with a flexible boot sleeve.
3. Motor: Blower motor will be a TEFC, 480V/3/60
    i. Motor Sizes: will vary based on heater and burner rated output.

HEATER CAPACITY	BLOWER MOTOR HP
1 - 5 MMBTU	2 HP
5.5 - 8 MMBTU	7.5 HP

T. Modulating Air/Fuel Valve and Burner: The heater burner shall be capable of a 3:1 turndownratios of the firing rate without loss of combustion efficiency or staging of gas valves.

U. Ignition: Ignition shall be via spark or proven pilot ignition with 100 percent main-valve shutoff and electronic flame supervision.

V. Heater Tank and Tower Access: Stainless Steel service access panels shall be removable to gainaccess to the heater's hot water tank and heat transfer tower allowing for easy access during heater maintenance. Access panels will be bolted and gasketed and will be free of leaks during allphases of heater operation.

2.3 GAS SUPPLY

A. Gas supply pressure: The gas supply pressure to each heater will be per each model as listedbelow:

HEATER CAPACITY	MIN. GAS PRESSURE	MAX. GAS PRESSURE
1 - 5 MMBTU	14" W.C.	42" W.C.
5.5 - 8 MMBTU	1.5 PSIG	4 PSIG

B. The above stated minimum supply pressure is the minimum gas pressure required at the heater gastrain inlet connection at the rated heater fuel gas flow rate.

C. Maximum Allowable Working Pressure (MAWP) for the gas train is 10psig. Customer to provideover-pressure protection on the fuel gas supply to avoid exceeding the heater's fuel gas train MAWP.

D. Gas piping should be sized in accordance with the tables in the Standard National Gas Code (NFPA 54) or by other engineering methods approved by local Authority Having Jurisdiction. Thepiping should be sized for the proper volumetric flow rate of the gas to the heater and any other devices utilizing a common source.

E. Gas supply piping at the heater's gas inlet shall be configured to include necessary drip-legs,Sediment trap, strainers and filters as required by NFPA 54

2.4 WATER SUPPLY

A. Water supply pressure: The water supply pressure to each heater will be per each model as listedbelow:

HEATER CAPACITY	MIN. WATER PRESSURE
1-5 MMBTU	19PSIG @ 150gpm
6-8 MMBTU	26PSIG @ 123gpm

B. The above stated minimum supply pressure is the minimum water pressure required at the heater'swater inlet connection at the rated maximum flow rate. Customer water supply pressure losses through supply water piping, regulators and valves must be accounted for to ensure this minimum inlet pressure is met at the heater.

C. Maximum allowable supply pressure for the water supply is 125psig at 180°F

2.5 COMPRESSED AIR SUPPLY

A. Compressed Air supply will be used to actuate the heaters water flow valves. This instrument airquality compressed air will be provided as follows:

Supply Pressure	100psig-125psig
Air Flow Required	1.0scfm
Dew Point	-40°F at 100psig
Particulate Size	Maximum of 40 microns
Lubricant content	Zero entrained oils
Contaminants	Free of corrosive and hazardous gases

2.6 CONTROLS

A. The heater control system shall be contained in a Heater Control Panel and a BMS Sub-Panel. These two panels shall be Underwriters Laboratories listed. Control panel and BMS sub-panel willbe NEMA type 1, carbon steel enclosure, with grey primed exterior and white enamel interior.
   1. Control Panels will be constructed for indoor, general wiring location.
   2. Panel wiring will be as noted in section 2.07 below.
   3. Heater conduit will be EMT type with compression couplings and Series-5 condulets.

B. The heater control panel will coordinate the burner operation, manage inlet water flow to the heater, recirculating water flow through the heater, and transfer water flow from the heater to meet the required design hot water outlet requirement. All heater controls will be monitored and controlled through the panel's PLC and displayed on the panel HMI display, if applicable.

C. The panels PLC will monitor and control the heater's water temperature by cycling the burner ONand OFF and modulating the burner firing rate. When the water temperature falls below setpoint, the PLC will deliver a "Call for Heat" signal to the heater's burner management system which willinitialize the burner startup, pre-purge, pilot ignition and main burner ignition sequence. Once themain burner is lit the PLC will modulate the burner as necessary to meet the required heat outputfrom the heater. When the heater water temperature is satisfied the PLC will remove the "Call forHeat" signal to the BMS and the burner will shutdown.

D. The control panel operators and controllers will consist of the following:
   1. Single point 480Vac/3/60 power termination
   2. Burner Blower, recirculating water pump and transfer pump motor starter and overload protection
   3. 480Vac x 120Vac step-down transformer and primary and secondary fusing
   4. 24Vdc Power supply
   5. Allen Bradley Micrologix 1400PLC with PanelView 800 touchscreen HMI Display
   6. Heater Power On Indicator
   7. Heater Power OFF-ON Selector Switch
   8. Heater Emergency Shutoff Push-Button
   9. Siemens LMV Control Interface Display

E. The heater burner management system (BMS) sub-panel shall contain a Siemens LMV control system that will centralize the monitor the heater and burner gas train sensors that confirm it is safeto operate the burner upon receiving a "Call for Heat" signal from the PLC. This BMS system will provide the following additional features:
   1. Monitor Heater and burner safeties to include:
      a. High Stack Temperature Shutdown
      b. High Chamber Temperature Shutdown
      c. High Burner Gas Pressure
      d. Low Burner Gas Pressure
      e. High Heater Water Temperature
      f. Minimum Heater Water Level
      g. Burner Blower Low Air Pressure
      h. Main Gas Valve, Proof of Closure Switch, if applicable
   2. Electronic Pilot ignition
   3. Proof of Pilot and Main flame through use of an Ultraviolet flame sensor
   4. OFF/ON control of Pilot solenoid valve
   5. OFF/ON control of Burner Dual Main Gas Shutdown Valves

6. Start / Stop control of burner blower motor

7. Modulation and ratio of burner's combustion air damper and fuel valve

F. The heater BMS and PLC controls shall annunciate heater and burner sensor status and includeextensive self-diagnostic capabilities. Alarm messages will be displayed on the Heater Control Panel HMI Display with additional BMS diagnostic messages displaying on the Siemens LMV Controller.

G. Each heater shall include an electric, single-seated combination safety shutoff valve/regulator withproof of closure switch in its gas train. Each heater shall incorporate chamber and tower over- temperature protection requiring local manual reset, in accordance with ASME CSD-1.

H. Multi-tower heaters shall have integrated Heater Sequencing Logic capable of multi-unit sequencingwith Primary / Secondary functionality and parallel operation. The system will incorporate the following capabilities:
   1. Efficiently sequence 2 heaters on the same system to meet load requirement.
   2. Automatically rotate primary / secondary heater based on run hours and number of startsper burner in an effort to equalize run hours for each heater.
   3. Option to manually designate primary and secondary heater
   4. Automatic bump-less transfer of primary function to the secondary heater in case of primaryheater failure; primary / secondary status should be shown on the individual unit displays.

2.7 ELECTRICAL POWER

A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified OGI Standards.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the heater control panel. Multiple field power connection may be required to reassemble heater external blower.

C. Line Power and Control power circuits will have the following current interrupted short circuit rating:
   1. 480Vac/3/60 Line Power: 5kAIC
   2. 120Vac/1/60 Control Power: 5kAIC

D. Power and Control wiring will be of the following Minimum Gauge and insulation
   1. 480V/3/60 Power: #12AWG, 600V, 90°C, stranded single conductor, THHN.
   2. 120Vac/1/60 Control Power: #16AWG, 600V, 90°C, stranded single conductor, TFFN.
   3. 24Vdc Control Power: #16AWG, 600V, 90°C, stranded single conductor, TFFN.
   4. Analog signal conductors: #20AWG, TSP, 300V, 105°C, stranded multi-conductor, PVC insulation and jacket, with shield and drain wire.
   5. Thermocouple Cable: #20AWG, TSP, 300V, 105°C, solid multi-conductor, PVC insulationand jacket, with shield and drain wire. Type K TC Cable will be RED (-) YEL (+)

2.8 EXHAUST STACK AND COMBUSTION AIR SUPPLY

A. The heater exhaust stack will be supplied and installed by the Customer and must:
   1. Be constructed of 304 stainless steel and extend from the heater discharge to the outside ofthe building at least 5' above the roof penetration.
   2. Be self-supported off the Customer building or room structure.
   3. Be the same diameter of the heater exhaust diameter and should not have any bends, trapsor reductions that could restrict the flow of exhaust gas and water vapor. Condensed water should be

able to flow back down the stack and re-enter the heater.
4. Ensure that all exhaust stack joints are watertight.
5. Include a weather cap with bird screen on the top of the stack.
6. Comply with local codes and standards.

B. Combustion air for the heater's burner(s) will be drawn from the room the heater is installed.
   1. Provisions must be taken by the Customer to provide outside air to the room that will notresult in a negative air pressure in the room when the heater's burner(s) are operating.

C. Follow guidelines specified in stack manufacturer's Operation and Installation Manual.

2.9 SOURCE QUALITY CONTROL

A. Burner and Leak Test: Factory adjust burner to eliminate excess oxygen, and carbon monoxide,emissions in flue gas, and to achieve combustion and thermal efficiency.
B. Perform leak testing of heater shell, water piping and fuel gas train.
C. Test and inspect factory-assembled heater, before shipping according to Manufacturer's typical functional test.
   1. If the heater is not factory assembled and fire-tested, the Manufacturer is responsible for allfield assembly and testing.
   2. Multi-Tower heaters system must be, at minimum, individually test-fired, and the lead / lagcontrol of each heater functionally tested for coordinated control sequencing between the two heaters.
D. Allow Owner access to source quality-control testing of heater. Notify Customer fourteen days inadvance of testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before heater installation examine roughing-in for concrete equipment bases, anchor-bolt sizes andlocations and piping and electrical connections to verify actual locations, sizes and other conditions affecting heater performance, maintenance, and operations.
   1. Final heater locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where heater will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HEATER FIELD INSTALLATION AND CONNECTIONS

A. Install heater on a level concrete pad. Concrete must be designed to support the weight of the completely assembled heater and the maximum water capacity of the heater. Install heater fuel gaspiping according to NFPA 54.

B. Install heater main tower assemblies, as necessary.

C. Assembly and install the heater trim.

D. Install electrical devices furnished with heater not specified to be factory mounted.

E. Install control wiring to field-mounted electrical and instrumentation.

F. Below are Customer field interconnection requirements for this heater.
   1. Field interconnection requirements will be as indicated on the heater general arrangementfor piping, fittings and specialties.
   2. Ensure that interconnected piping is supported properly to avoid any pipe loads or momentsbeing transferred to the heater fuel gas and water connections.
   3. Field piping installed adjacent to heater should permit service and maintenance and shouldnot be supported off the heater.
   4. Install piping from heater tank drain connections to nearest floor drain. Piping shallbe at least full size of drain connection and should include an isolation valve.
   5. Install a syphon type overflow drain from the heater water reservoir to the nearest floor drain.
   6. Connect gas piping to heater gas-train inlet with unions. Piping shall be at least full size of gas train connection. Provide a piping reducer if required. Natural Gas supply piping will besized and installed per the National Gas Code Standard (NFPA 54) and will be:
      i supplied with additional pressure regulation and over pressure protection to meetheaters natural gas minimum and maximum supply pressures.
      ii of sufficient diameter to ensure maximum rated capacity of the heat can be achieved.
   7. Connect water piping to the heater water inlet and outlet connections as shown on suppliedheater general arrangement drawing.
      i Provide necessary water strainer and pressure regulation and over pressure protection for the water inlet piping.
      ii Ensure water inlet and outlet connection include manual isolation valve and provideunions or flanges as necessary for disassembly.
   8. Customer Supplied Heater Exhaust Stack
      i Exhaust stack should be stainless steel extending from the heater discharge to theoutside of the building at least 5’ above the roof penetration.
      ii The exhaust stack must be same diameter of the heater exhaust diameter.iii Ensure that all exhaust stack joints are watertight.
   9. Ground heater using ground lugs provided on heater lower tank per NFPA 70
   10. Connect power and control wiring according to heater installation manual, control panel drawing and control wiring diagram.
      i Interconnecting wiring and conduit will be sized by Customers field electrical contractors. Installation will apply appropriate wiring methods according to NFPA 70,local codes and standards.
      ii All penetrations to the heater control panel should be made in the bottom of theheater control panel using gasketed UL listed threaded hubs.

3.3 FIELD STARTUP ASSISTANCE

A. Field startup, and inspections and prepare test reports performed by factory- authorized service representative to inspect component assemblies and equipment installation, toinclude the following:
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist intesting.
   2. Tests and Inspections
      a. Perform installation and startup checks according to manufacturer's written instructions.
      b. Review installation gas and water piping leak inspection documents.
      c. Inspect heater upper transfer tower packing material level and demister pad installation
      d. Perform leak inspection of heater gas and water piping, and heater tower seam inspection. Repair leaks and retest until no leaks exist.
      e. Start units to confirm proper burner blower and water pump motor rotation.
      f. Test and adjust controls and safeties. Replace damaged and malfunctioning controlsand equipment as defined by the Heater’s Warranty Statement
         1) Check and adjust initial operating set points and high- and low-limit safety setpoints

of fuel supply, water level and water temperature.

2) Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3. Remove and replace malfunctioning units and retest as specified above.
4. Tune burner and adjust air-fuel ratio and combustion.
5. Confirm water and gas supply pressure during full range of heater operation.
6. Perform field performance test to determine capacity and efficiency of heater.
7. Test for full capacity.
8. Document test results in a report and submit to Customer.

END OF SECTION 22 3460

SECTION 22 4001 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 0100 apply to this Section.

1.2 SUMMARY

A. Furnish and install plumbing fixtures as described in Contract Documents.

B. Before fixtures are ordered, the Contractor shall submit a complete list of plumbing fixtures, giving the catalog number, cut and make, for approval. Fixtures shall not be ordered until this list is approved.

PART 2 - PRODUCTS

2.1 GENERAL

A. Interior exposed pipe, valves, and fixture trim shall be chrome plated or stainless steel.

B. Flow Control Fittings:
1. Vandal proof type and fit faucet spout of fixture used. Flow shall be controlled as required by local codes.

C. Furnish and install the necessary plumbing fixtures in quantity as shown on plans. Provide all necessary valves, chrome plated 17 gauge or cast "P" traps, stops with risers, fittings, and accessories to make the job complete with the fixtures specified on the drawings. Exposed stops to be equal to Brasscraft with compression inlet, chrome plated nipples, cross handles, ¼ turn ball valves and flexible risers.

D. Fixtures shall be PROFLO, Kohler, Sloan, Briggs, Eljer, American Standard, or an approved equal. Specialties shall be Zurn, Josam, MiFab, J. R. Smith, Wade, or Watts.

E. Toilet seat manufacturers shall be Beneke, Church, Olsonite, or Bemis.

F. Carrier and wall hydrant manufacturers shall be Smith, Zurn, Wade, Josam, or Watts.

G. Stainless steel sink manufacturers shall be Elkay, Just or Mustee.

H. Drinking fountain manufacturers shall be Elkay, Halsey Taylor, Haws, Cordley, Sunroc, or Oasis.

I. Pressure balance mixing valves shall be Powers, Lawler, Leonard, or Symmons.

J. Stainless steel showers and wash fountains shall be Bradley or Acorn.

K. Thermostatic mixing valves shall be Powers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures including traps and accessories with accessible stop or control valve in each hot and cold water branch supply line.

B. Mounting – Refer to Architectural Elevations:
   1. Urinals:
      a. Standard - 20 inches from floor to bottom lip.
      b. Handicap - 17 inches from floor to bottom lip.

C. Make fixture floor connections with approved brand of cast iron floor flange, soldered or calked securely to waste pipe.

D. Make joints between fixtures and floor flanges tight with approved fixture setting compound or gaskets.

E. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point edges.

F. Cleanouts: Provide and set full size cleanouts at foot of each riser, and ends of branches from toilets, at points where a change of direction occurs, on exposed and accessible traps, at points where required to remove rust accumulation or other obstructions and as shown on plans. Set screw cap in cleanout with graphite paste. Location of all cleanouts subject to approval of inspector.

G. Traps: Install "P" traps in branch lines from floor drains or where required. Traps installed in connection with threaded pipe shall be recess drainage pattern. Traps installed in connection with stainless steel drainage pipe shall be of the same quality and grade as the pipe. Traps installed in connection with fixtures shall have a seal of not less than 2" nor more than 4". Exposed traps shall be chrome plated cast brass or chrome plated 17 gauge tubular type. Provide trap primers as required by Code.

3.2 FIXTURE INSTALLATION

A. Provide stop valves and 18" minimum air chambers on all water connections to fixtures. Furnish and install wall carriers for wall mounted fixtures, wood backing, where necessary, to be installed by General Contractor at the direction of this Contractor. Provide exact locations, including proper mounting heights, obtained from details on drawings and from manufacturer's specifications. Provide hudee rims for countertop installations.

B. Interior exposed pipe, valves, and fixtures trim shall be chrome plated.

C. Complete installation of each fixture including trap and accessories with accessible stop or control valve in each hot and cold water branch supply line. Make fixture floor connections with approved brand of floor flange, soldered or caulked securely to S.S. waste pipe. Make joint between fixture and floor flange tight with approved fixture setting compound or gaskets.

D. Polish chrome finish at completion of project.

E. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Paint all edges.

F. Install fixtures and fittings as per local codes and manufacturer's instructions.

END OF SECTION 22 4001

SECTION 22 4703 – HANDICAP DRINKING WATER COOLING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, General Provisions of Contract, including General and Supplementary Conditions and Section 22 05 01 apply to this Section.

1.2 SUMMARY

A. Furnish and install handicap drinking water cooling system as described in Contract Documents.

PART 2 - PRODUCTS

2.1 HANDICAPPED FOUNTAIN

A. Vandal proof operating bar on front and both sides. 7-1/2 GPH of 50 deg F water with 90 deg F room temperature, 1/5 horsepower compressor motor, 120 V, 60 Hz, single phase. One piece stainless steel back splash and basin. Flexi-guard or chrome plated brass bubbler.

B. Approved Manufacturers:
1. Sunroc
2. Halsey Taylor
3. Haws
4. Elkay
5. Oasis

2.2 HYDRATION STATION.

A. Touchless sensor activated, 1.5 GPM Quick Fill, with automatic 20 second shut-off timer. 120V, 60 HZ single phase.

B. Visual user interface display includes:
1. Innovative Green Ticker counting number of bottles saved from waste.
2. Filter moniter indicating when replacement is needed.

C. Water Sentry Plus Filler:
1. 3000 Gallon Capacity.
2. Quick ¼ turn for easy installation.
3. Polypropylene pre-filter mesh prevents coarse sediment from entering filter.
4. Made with activated carbon and patented ATS lead-removal media.
5. Final filter mesh prevents loose carbon from entering water.
6. ANSI/NSF Standard 42 and 53.

D. Approved Manufacturers:
1. Sunroc
2. Halsey Taylor
3. Haws
4. Elkay
5. Oasis

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor bottom of fountain to wall.

B. Top surface to be 32 inches above floor unless required otherwise by local code.

C. Install 3/8 inch IPS union connection and Chicago No. 376 stop to building supply line.

D. Install 1-1/4 inch IPS slip cast brass "P" trap. Install trap so it is concealed.

END OF SECTION 22 4703