

DIVISION 220000 – PLUMBING

Latest Edition: 10-28-2024 See Underlined Text for Latest Edits

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off “Underlines”)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Division.

1.2 SCOPE:

- A. The plumbing contractor shall furnish all labor, material, tools, equipment and services necessary and incidental for installing all plumbing systems shown on the drawings, indicated in the specification, or necessary to provide a finished installation. The finished installation shall be in perfect working condition and be ready for continuous and satisfactory operation. The project area is located in

Note: Engineer to complete above paragraph.

1.3 CODES AND REGULATIONS

- A. All materials furnished and all work installed shall comply with the codes and regulations adapted by the State of Maryland and recommendations of the following bodies:
 1. International Building Code (IBC)
 2. International Mechanical Code (IMC)
 3. International Plumbing Code (IPC)
 4. International Fuel Gas Code (IFGC)
 5. National Electric Code (NEC)
 6. Maryland State Health Department
 7. Underwriters Laboratories (UL)

1.4 RESPONSIBILITY

- A. The Construction Manager/General Contractor (CM/GC) shall be responsible for all work included in this Division. The delegation of work to the contractors shall not relieve him of this responsibility. Contractors who perform work under this Division shall be responsible to the CM/GC.

1.5 SITE VISIT

- A. Prior to preparing the bid, the mechanical subcontractor shall visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and existing field conditions that could affect the work. No additional compensation will be made to the contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.6 OUTAGES

- A. For all work requiring an outage, the plumbing contractor shall submit an outage request to the UMB Project Manager, using the UMB Standard Request for Outage Form which is available through the UMB Design and Construction Web Site at:
<https://www.umaryland.edu/designandconstruction/resources/contractors/>
- B. The existing mechanical/electrical/fire protection systems shall remain operational unless turned off by University personnel during the construction of the project.
- C. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled at least ten business days (10) days in advance with the UMB Design and Construction Department. Outages shall be performed during normal duty hours. If necessary, some outage work may be performed outside normal hours if approved by UMB.
- D. All plumbing outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon by the contractor and the UMB Design and Construction Department.
- E. The plumbing contractor shall include in his price the cost of all premium time required for outages and other work which interferes with the normal use of the building, which will be performed, in most cases, during other than normal work time and at the convenience of the University.
- F. The operation of plumbing valves or switches; required to achieve an outage must be operated by University personnel only. Unauthorized operation of plumbing valves, power switches, or other control devices by contractors and their personnel will result in extremely serious consequences for which the contractor will be held accountable.

1.7 SUBMITTALS

- A. General: For general requirements see Architectural Specification Division 01 Section "Submittal Procedures". Also comply with the following:
 - 1. UMB requires all that all submittals, which includes shop drawings, product data, related equipment maintenance manuals, warranty documentation and all other pertinent information be submitted electronically by the manufacturer, trade contractors, and construction manager as a "pdf" file for review as required by

Division 01. Partial submittals are not acceptable and will be returned without review.

2. After contract award and before material is ordered submit electrically all product data, shop drawings and other such descriptive data as the Engineer may require to demonstrate compliance with the contract documents as required by the contract clauses for review and approval.
3. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable publication references, years of satisfactory service, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish.
4. Plumbing shop drawings must be developed by computer software. Any hand drawn shop drawings will be rejected and will not be reviewed.
5. Submittals will be reviewed for general compliance with design concept in accordance with contract documents, but dimensions, quantities, or other details will not be verified.
6. Product Submittals shall include the following items unless otherwise noted:<Edit List for Project Requirements>
 - a. Article 2.2, Fire Stops & Smoke Seals for Wall and Floor Sleeve Applications
 - b. Article 2.3, Plumbing Piping Systems
 - c. Article 2.4, Pipe Sleeves
 - d. Article 2.5, Piping Specialties
 - e. Article 2.6, Plumbing Valves
 - f. Article 2.7, Hangers and Supports
 - g. Article 2.8, Identification System
 - h. Article 2.9, Plumbing Fixtures
 - i. Article 2.10, Plumbing Specialties
 - j. Article 2.11, Plumbing Equipment
 - k. Article 2.12, Pipe Insulation
 - l. Article 2.13, Flushing and Disinfecting
 - m. Article 2.14, O&M Manual
 - n. Article 2.15, Housekeeping Pad
 - o. Article 2.16, Grout
 - p. Warranties and maintenance instructions shall be included in the O & M Manual only. Do not include this data in the Product Submittals.
7. Additional Data: Subject to project requirements, in addition to the product data indicated in the paragraph above the following additional data may be required:
<Coordinate with UMB, delete if not required >

- a. Coordinated drawings
 - b. Samples
8. Submittal File Format: File formats and names for each submittal shall be electronically as follows:
- a. File Formats:
 - 1) Product Data: “pdf” file format.
 - 2) Design Shop Drawings: “pdf” and “dwg” file formats.
 - 3) Coordinated Drawings: “pdf” or “dwg” file formats.
 - 4) Schedules: “xl” file format.

1.8 SAMPLES

- A. Samples of materials to be used on the work shall be submitted when requested and shall be subject to approval by the A/E and the UMB Design and Construction Department.

1.9 IDENTIFICATION BADGES

- A. Contractors must obtain photo identification cards for all employees who will be at the construction site. The University will charge the contractor \$25.00 for each badge as a deposit of which \$20.00 will be returned when the badge is returned. Lost photo I.D. card will cost \$25.00 for another replacement card. (The above charges are subject to change without notice.)

1.10 HAZARDOUS MATERIALS

- A. Identification and removal of hazardous materials (asbestos, lead paint, PCBs) is not part of this contract. If questionable material is encountered, notify the University Project Manager and the University Environmental Health and Safety in writing immediately. The University shall then arrange for investigation and possible abatement of the material. Contractor shall schedule his work to accommodate hazardous material removal by the Owner.

1.11 FUNCTIONAL TESTING OF NEW PLUMBING SYSTEMS

<Coordinate with UMB, if full Cx is included in project, edit section for Commissioning instead of Functional Testing >

- A. Summary: This article includes the requirements for functional testing of new Plumbing Systems, assemblies and equipment related to the project area.
- B. Functional Testing will be performed by UMB staff.
- C. Description: The following equipment and/or accessories shall be tested as part of this project: <Edit for Project Requirements>

1. Plumbing Systems:
 - a. Plumbing Fixtures:
 - 1) Water closets.
 - 2) Urinals.
 - 3) Lavatories.
 - 4) Bottle filling stations.
 - 5) Mop sinks.
 - 6) Countertop sinks.
 - 7) Laboratory sinks.
 - b. Plumbing services for:
 - 1) Fume hoods.
 - 2) Biosafety cabinets.
 - 3) Laboratory gas outs.
 - c. Laboratory Safety Equipment:
 - 8) Eye washes.
 - 9) Safety showers.
 - 10) Safety shutoff valves.

1.12 MOTOR REQUIREMENTS

A. General Requirements:

1. Compliance: Comply with NEMA MG 1 unless otherwise indicated.
2. Motor Requirements: Requirements below apply to motors covered by this Division except as otherwise indicated.
 - a. Motors 1/2 HP and Larger: Three phase.
 - b. Motors smaller than 1/2 HP: Single phase.
 - c. Frequency Rating: 60 Hz.
 - d. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
 - 1) 120 V Circuit: 115 V - motor rating.
 - 2) 208 V Circuit: 200 V - motor rating.
 - 3) 240 V Circuit: 230 V - motor rating.
 - 4) 480 V Circuit: 460 V - motor rating.
3. Minimum service factor shall be 15% and shall apply at frequency and utilization voltage at which motor is connected. Provide motors which will not operate in service factor range when supply voltage is within 10% of motor voltage rating.

4. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100% of rated capacity.
5. Temperature Rise: Based on 40°C ambient except as otherwise indicated.
6. Enclosure: Open drip proof, unless otherwise specified. Provide screen over slots, where slots will permit passage of human extremities.
7. Provide adjustable motor slide base for belt driven equipment. Include adjusting bolts and locknuts.
8. Motors without VFD's: Motors 5 HP and lower shall be variable speed ECM motors with combination starter, disconnect and auxiliary contacts to interface with the BAS.
9. Motors with VFD's: Motors larger than 5HP shall be equipped with a VFD including required accessory to interface with the BAS. See Division 260000_article for Variable Frequency Drive for requirements.
10. Shaft Grounding Rings: Provide on all motors with VFD's.

B. Three Phase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Minimum motor efficiencies shall be as follows:

HP	Percent Efficiency, Minimum
1 and less	82.5
1½	84.0
2	84.0
3	87.5
5	87.5
7½	89.5
10	89.5
15	91.0
20	91.0
25	92.4
30	92.4
40	93.0
50	93.0
60	93.6
75 and larger	94.1

3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.

5. Rotor: Random-wound, squirrel cage.
6. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
7. Temperature Rise: Match insulation rating.
8. Insulation: [Class F] <Insert class>.
9. Code Letter Designation:
 - a. Motors 15 HP and Larger: NEMA starting Code F or Code G. <Edit Code>
 - b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
10. Motor Frames: Motor frames constructed of aluminum will not be permitted. Motor frame sizes 184T and larger shall be constructed of cast iron. Motor frames sizes smaller than 184T shall be constructed of rolled steel.

C. Polyphase Motors with Additional Requirements:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers: Motor ratings, characteristics, and features shall be coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

D. Single Phase Motors:

1. Motors larger than 1/20 hp shall be one (1) of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

1.13 WARRANTY/GUARANTEE

- A. All materials, equipment, etc. provided by the general contractor and/or his subcontractors shall be warranted and guaranteed to be free from defects in workmanship and materials for a period of two (2) years from the date of substantial of completion and acceptance of work by UMB. Any defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the contractor without cost to the owner, within a reasonable time, to be specified by UMB. In default thereof, owner may have such work done and charge the cost of same to the contractor. In addition to the above statement the Warranty/Guarantee Period shall also include all labor cost related to all warranty work. For compressorized equipment include an additional three (3) year Warranty/Guarantee Period.

PART 2 – PRODUCTS

2.1 LISTED MANUFACTURERS

- A. Listed Manufacturers: The manufacturers indicated in Part 2 represent the basis for design and identify the minimum level of quality for materials and equipment, specified in this Division, that are acceptable to UMB. Unless “or equal” is included as an option, substitutions are not allowed, except under the following condition. During bid phase, contractors may submit material and equipment by non-listed manufacturers provided said submittals meet the requirements of these specifications. All submitted materials and equipment are subject to approval by the A/E and UMB. Reference: Division 1 Substitution Section.

2.2 FIRE STOPS & SMOKE SEALS FOR WALL & FLOOR SLEEVE APPLICATIONS

- A. General: Provide fire stops, and smoke sealant materials for all plumbing services penetrating through rated assemblies. See Architectural Specification Division 07, Section “Penetration Firestopping” for sealant material requirements. Services include:
 1. Plumbing penetrations include all plumbing piping systems.
- B. New Construction: All new penetrations shall be provided with a pipe sleeve and sealant materials.

- C. Existing Construction: All new service penetrations through existing rated assemblies shall be provided with a pipe sleeve and sealant materials. All existing unsealed penetrations for services passing through existing rated assemblies within the project area shall be provided with sealant materials.
- D. Project Area: The project area shall include the finished spaces and related sections of the utility shafts within the project area footprint.
- E. Wall Pipe Sleeve Applications: Pipe sleeves shall be required for all new pipe penetrations through rated wall assemblies and non-rated CMU walls. Where pipe sleeves are installed in non-rated CMU walls fire rated sealant materials are not required. Provide acoustical caulking to seal the annular spaces between the sleeve and the bare pipe or pipe insulation on each end with one half (1/2) inch caulking all around the annular space.
- F. Floor Pipe Sleeves Applications: Pipe sleeves are required for all new pipe risers passing through floor slabs.

2.3 PLUMBING PIPING SYSTEMS

- A. General: Provide all piping systems indicated on the drawings and as specified below, including all labor materials and equipment necessary for a complete installation.
- B. Plumbing Piping Systems: Plumbing piping systems includes non laboratory sanitary and vent, laboratory acid waste sanitary and vent, domestic water, laboratory water, laboratory natural gas, and laboratory specialty gas piping systems as follows:
 - 1. Laboratory Acid Waste Sanitary & Vent Piping System: Pipe, fittings and joints shall be as follows:
 - a. Pipe and Fittings: Laboratory acid waste sanitary & vent piping and fittings shall be Blue Line Schedule 40 flame retardant polypropylene pipe and fittings as manufactured by Orion. Pipe and fittings shall conform to ASTM F1412, ASTM D4101, and ASTM D3311.
 - b. Joints Systems: For joints comply with the following:
 - 1) No Hub Mechanical Joints: Use no hub mechanical joints and bands to connect 'P' traps to plumbing fixture tail pieces and floor drain outs and to the associated drain piping. No Hub mechanical joints and bands shall be as manufactured by Orion.
 - 2) Electro Socket Fusion Joints: Laboratory acid waste sanitary & vent pipe and fittings concealed in partitions and toilet room plumbing chases, above lay in ceilings, in accessible utility shafts and mechanical rooms shall be assembled using the electro socket fusion

- joint system for all new acid waste piping for hermetically sealed joints.
- 3) No Hub Mechanical Joints: Laboratory acid waste vent pipe and fittings above lay in ceilings, in accessible utility shafts and mechanical rooms shall be assembled using the no hub mechanical joint system for new acid waste vent piping. (contractor's option)
 - 4) Connections to Other Materials: Connections required between polypropylene and other types of piping shall be made with Orion adapters according to manufacturer's recommendations. (Contractures Option)
- c. Pipe and Fittings - Ceiling Plenums Only: Laboratory acid waste sanitary & vent piping located in ceiling plenums shall be PVDF Schedule 40 flame retardant Polyvinylidene fluoride pipe and no hub fittings as manufactured by Orion. Pipe and fittings shall conform to ASTM F1673, and ASTM D3311. For joints comply with the following:
- 1) Electro Socket Fusion Joints: Laboratory acid waste sanitary & vent pipe and fittings concealed in ceiling plenums shall be assembled using the electro socket fusion joint system for all new acid waste piping for hermetically sealed joints.
 - 2) Connections to Other Materials: Connections required between polypropylene and other types of piping shall be made with Orion adapters according to manufacturer's recommendations. (Contractures Option)
2. Non - Laboratory Sanitary & Vent Piping System: Pipe, fittings and couplings shall be as follows:
- a. Sanitary Piping Below Grade in the Building: Sanitary piping below the floor slab shall be cast iron service weight hub and spigot pipe, fittings and joints with compression gaskets. Pipe and fittings shall conform to ASTM A74. Gaskets shall conform to ASTM C 564. All Cast Iron Soil Pipe and Fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.
<delete if not required>
 - b. Sanitary & Vent Piping Above Ground Inside the Building: Pipe and Fittings: Sanitary & vent piping shall be Schedule 40 cast iron no hub pipe and fittings, serving Non-Laboratory areas only. All Cast Iron Soil Pipe and Fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

- c. Pipe Couplings: comply with the following:
- 1) Husky SD 4000 Couplings: All couplings shall be a heavy-duty, all stainless steel coupling to join No-Hub pipe and fittings as engineered by Anaco. Each coupling shall include a super-duty corrugated shield of sufficient width to accommodate additional surface-bearing sealing clamps. All SD 4000 couplings shall be designed to be installed with a pre-set torque wrench calibrated at eighty (80) inch pounds to accommodate the 305 stainless steel three eighths (3/8) inch Hex Head screws.
 - 2) Waste and Vent Pipe Sizes One and One Half (1-1/2) Inch Through Four (4) Inch: The one and one half (1-1/2) inch through four (4) inch diameter couplings shall consist of three (3) inch wide corrugated 304 stainless steel shield in conjunction with four (4) stainless steel clamps, secured in place by means of an affixed and “floating” eyelet to allow clamp “travel” during tightening.
 - 3) Waste and Vent Pipe Sizes Five (5) Inch Through Ten (10) Inch: The five (5) inch through ten (10) inch diameter couplings shall consist of four (4) inch wide corrugated 304 stainless steel shield in conjunction with six (6) stainless steel clamps, secured in place by means of an affixed and “floating” eyelet to allow clamp “travel” during tightening.
- d. Material Specifications:
- 1) Clamp: Type 304 AISI stainless steel
 - 2) Screw: Type 305 AISI stainless steel 3/8 inch screws
 - 3) Shield: Type 304 AISI stainless steel, corrugated. Shield thickness 0.015
 - 4) Gasket: The gasket shall be manufactured from a properly vulcanized virgin compound in which the primary elastomer is polychloroprene (neoprene) conforming to ASTM C 564. Oil Immersion test: 80% max. Volume Change after immersion in IRM 903 for seventy (70) hours at 212° F.
- e. Certifications & Standards: Tested & Certified to:
- 1) ASTM C1540
 - 2) ASTM C564
 - 3) FM 1680 Class 1
3. Domestic and/or Laboratory Water Piping Systems: Domestic and/or laboratory water systems include cold, hot, and hot water return piping systems. Pipe, fittings and joints shall be as follows:

- a. Solder Connection: Heating water piping two (2) inch and smaller shall be type 'L' copper tubing assembled with wrought copper fittings and 95-5 solder.
 - b. Press End Connection: Domestic and/or laboratory water piping two (2) inch and smaller shall be type 'L' copper tubing assembled with Viega ProPress copper fittings with EPDM seals and press connection with EPDM seals. (Contractors Option)
 - c. Press End Connection: Domestic and/or Laboratory water piping two and one half (2-1/2) inch to four (4) inch shall be type 'L' copper tubing assembled with Viega ProPress (press end) XL-C copper fittings with EPDM seals and press connection with EPDM sealing. (Contractor Option)
 - d. Victaulic Connections: Domestic and/or laboratory water piping two and one-half (2-1/2) inch and larger shall be hard drawn type 'L' copper tubing conforming to CTS US Standards ASTM B88 and ASTM B306 using Victaulic rolled grooved ends with fittings and joints as follows: (Contractors Option)
 - 1) Fittings: Copper coated ductile iron grooved end fittings for elbows, tees, increasers, reducers, 'Y' fittings, conforming to ASTM A - 395, grade 65-45-15. (Contractors Option)
 - 2) Joints: Vic Style 606 – Copper coated ductile iron couplings with Grade 'E' EPDM gasket material, carbon steel nuts and bolts, conforming to ASTM A-563, Grade 65-45-12. Vic Flange Adapters: Vic Style 641, copper coated ductile iron, conforming to ASTM A-536, grade 65-45-12. (Contractors Option)
4. Laboratory Natural Gas Systems: Pipe, fittings and joints shall be as follows:
- a. Threaded Steel Pipe: One half (1/2) inch to three (3) inch piping shall be Grade "B" Schedule 40 black steel pipe assembled with threaded fittings, matching existing piping systems.
 - b. Press End Steel Pipe: One half (1/2) inch to three (3) inch piping shall be Grade "B" Schedule 40 black steel pipe assembled with Viega Mega Press 'G' carbon steel fittings with HNBR seals and assembled using Viega press connections with HNBR seals and the smart connection feature. (Contractor Option)
 - c. Natural Gas Piping System (NGPS) in HSF-3: The existing NGPS in HSF-3 is a Viega ProPress G Piping System which is no longer available from

- Viega. All new piping must comply with paragraphs 'a' and/or 'b' above and the following:
- 1) Piping Two (2) Inch and Smaller: Provide a Viega Copper Adapter Model 2911.1ZL with a male thread end and a solder end.
 - 2) Piping Two and One Half (2) Inch and Larger: Provide flanged connections with a solder end connection and a threaded end or plain connection and approved gasket material for natural gas service.
 - 3) See Execution Part 3 for installation requirements.
5. Laboratory Specialty Gas Piping Systems: Laboratory specialty gas systems include compressed air, vacuum, Co2, oxygen, nitrogen and xxx piping systems. Pipe, fittings and joints shall be as follows:
- a. Brazed Connections: Laboratory specialty gas piping shall be ACR type "L" seamless hard drawn soft annealed copper tubing, washed, degreased, and assembled with wrought copper fittings (ANSI B16.22) made especially for brazed silver solder connections per AWS A5.8 classification BCuP-3 brazed (Silver) filler material.
 - b. Press End Connections: Laboratory specialty gas piping two (2) inch and smaller shall be type 'L' copper tubing assembled with Viega ProPress copper fittings with EPDM seals and press connection with EPDM seals. (Contractors Option)
6. R/O Water Piping System: Piping Systems One Half (1/2) Inch through Two (2) Inch: Pipe, fittings and joints shall be either PVC, polypropylene or stainless steel as follows: <Edit for Project Requirements>
- a. PVC / Polypropylene Piping: PVC or Polypropylene pipe and fittings shall be as follows:
 - 1) Spears Pipe and Fittings: Provide Spears LX Schedule 80 pipe and fittings manufactured from a specialty Low-Extractable™, Polyvinyl Chloride (PVC) compound with a Cell Classification of 12343 per ASTM D 1784. All pipe and fittings shall be produced to Schedule 80 dimensions, manufactured in strict compliance to ASTM D 1785 for pipe, and ASTM D 2467 for fittings. All pipe, valves and fittings shall be as manufactured by the Spears manufacturing Company. All UPW pipe and fittings shall be bagged and sealed immediately after manufacture to maintain cleanliness and boxed and stored indoors at the manufacturing facility until shipped from the factory.

- 2) UPW process piping and fittings shall be manufactured from a specialty Low-Extractable™, Polyvinyl Chloride (PVC) compound with a Cell Classification of 12343 per ASTM D 1784. All pipe and fittings shall be produced to Schedule 80 dimensions, manufactured in strict compliance to ASTM D 1785 (pipe), and ASTM D 2467 (fittings). These products shall carry a Type II pressure rating and consistently meet or exceed the applicable Quality Assurance test requirements of these standards with regard to dimensions, workmanship, burst pressure, flattening resistance and end-product quality. All UPW process valves shall be True Union-style diaphragm or True Union-style quarter-turn ball valves produced from the same Low-Extractable™ PVC compound. All valve diaphragms and seats shall be PTFE; valve O-rings shall be EPDM or FKM as applicable. All valve union nuts shall have buttress-style threads. All valve components shall be replaceable. System components shall be joined utilizing specially formulated one-step cement for joining the system. All system components shall be manufactured in the USA by an ISO-certified manufacturer. All UPW piping shall be bagged and sealed immediately after manufacture to maintain cleanliness and boxed and stored indoors at the manufacturing facility until shipped from the factory. UPW process pipe and UPW piping components shall be those as provided by Spears® Manufacturing Company
- b. Stainless Steel Pipe and Fittings: Stainless Steel pipe and fittings shall be as follows: (Contractor Option)
 - 1) Viega type 316 stainless steel pipe and fittings with press ends for assembly by the pro press joint method. Pipe and fittings conforming to the requirements of ASTM A312 & A554. All fittings shall have EPDM seals.
7. Refrigerant Piping: <Delete if not required>
 - a. Refrigerant Piping shall be Copper Tube: ASTM B280, Type ‘ACR’ Type ‘L’, Seamless, hard drawn soft annealed seamless, factory cleaned and capped prior to shipping. Fittings shall be wrought copper fittings conforming to ANSI B16.22. Joints shall be AWS A5.8 classification BCuP-3 brazed (Silver) filler material.

2.4 PIPE SLEEVES

- A. Steel Pipe Sleeves: Steel pipe sleeves shall be standard black steel pipe Type E, Grade B, with plain ends conforming to ASTM A53/A53M.

- B. Cast Iron Pipe Sleeves: Cast iron pipe sleeves shall be standard weight cast iron pipe with plain ends conforming to ASTM A74 and CISPI – 301.

2.5 PIPING SPECIALTIES

- A. General: Provide all piping specialties were indicated on the drawings, details, and as specified below complete with all supports, fittings, etc. for Plumbing Piping Systems.
<Edit for Project Requirements>

- B. Piping Specialties:

1. Strainers:

- a. Domestic / Laboratory Water Piping System Piping Three (3) Inch and Smaller: Mueller Model LF 352 Y pattern lead free strainer, 250 psig working pressure; brass body with threaded ends, conforming to ASTM B 61, and perforated 20 mesh Type 304 stainless steel screen, blow-down drain with plugged valve and threaded hose connection.
- b. RO/DI Water Piping System: Strainers shall match piping system.

2. Thermometers: Provide Standard or Digital thermometers as manufactured by Terice - Basis of Design or approved equal.

- a. General Requirements: Standard adjustable type thermometer with seven (7) inch aluminum case, glass window, blue or red organic fluid, and insertion stem. Insertion length shall suite installation.
- b. Standard Thermometers: Service and Scale Range:
- 1) Plumbing Systems:
- a) Domestic Cold Water: 0°F to 100°F, with two (2) degree scale divisions.
- b) Domestic Hot Water: 30°F to 180°F, with two (2) degree scale divisions.
- c. Digital Thermometers – Plumbing Systems: Terice Model SX9, seven (7) inch adjustable angle, Solar Threm light powered digital thermometer with large 9/16-inch LCD °F/°C display, cast aluminum case NEMA – 4X/IP 65, Range minus 40°F to 300°F. Stem style and length to suit project requirements.

3. Pressure Gauges: Terice Type 450 series, four and one half (4-1/2) inch diameter aluminum case, Glass, Acrylic or Lexan window, one quarter (1/4) inch brass

socket, #735 – two (2) needle valve, pressure range suite system. Gauges shall have black letters on white background. On gauges used for steam service provide a Trerice #885-1 coil syphon for each gauge.

- a. Service and Scale Range in pounds per square inch (PSI):
 - 1) Plumbing Systems:
 - a) Domestic Cold Water: Zero (0) to two (2) times operating pressure.
 - b) Domestic Hot Water: Zero (0) to two (2) times operating pressure.
4. Backflow Preventers:
 - a. Hydronic Make Up Water Systems: Watts series LF-009-QT with a strainer, two (2) ball valves and one (1) air gap fitting, for one (1) to two (2) inch piping systems.
 - b. Mop Sink Housekeeping Connection: Watts series LF-009-QT with a strainer, two (2) ball valves and one (1) air gap fitting, for one half (1/2) inch pipe connection.
 - c. Water Service - Small Appliance: Watts series LF7R dual check with a union on one end, one half (1/2) inch x one half (1/2) inch, NSF-61 approved. Small appliances may include refrigerators, ice machines, coffee makers, and hot and cold water dispensers.
 - d. Watts series 288A Vacuum Breaker for equipment
 - e. Watts series 8A for hose bibs
 - f. Watts series Ng for eye wash fittings
5. Hose Bibb: Hose bibb Watts faucet type model SC-6, brass finish with a 'T' handle, size three quarter (3/4) inch.
6. Flexible Connections: Metraflex flexible pipe connectors with stainless steel hose and braid, and copper end tubes, or schedule 40 IPS pipe ends.
7. Pipe Alignment Guides: Metraflex style one (1) pipe alignment guide. Anchor guides to building structure.
8. Pipe Anchors: Anchors shall be constructed of steel sections and plates, assembled by bolting or welding and secured to building structure.
9. Dielectric Connections: Provide dielectric connections where nonferrous metal is joined to ferrous metal as follows:
 - a. Piping Two (2) Inch and Smaller: Provide Schedule 40 unlined type 316 stainless steel nipples, four (4) inched long with thread ends.

- b. Piping Two and One Half (2-1/2) Inch and Larger: Provide Type 'E' Full Flanged Isolation Gasket Kits with Dialectic Insulators for the pipe flanges.

2.6 PLUMBING VALVES

- A. Shut Off, Drain and Specialty Valves: All Shut Off, Drain and Specialty Valves installed in Plumbing Piping Systems shall be as specified below. Gate Vales will not be permitted for installation in these systems. All valves labeled as lead free (LF) shall be Lead Free Certified per NSF/ANSI 61 and NSF/ANSI 372. Only listed manufacturers and model numbers below are acceptable to UMB. <Edit paragraphs 1 – 9 for project requirements>

1. Shut Off Valves for Domestic/Laboratory Solder Joint Piping Systems:

- a. Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves used for shutoff duty shall be two (2) piece full port (FP) lead free ball valves with brass or bronze valve body with threaded end connections, solid tunnel bore 316 stainless steel ball and stem, RPTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below:

Apollo: 77FLF-140* Series, Brass Body. (FP)

Milwaukee: UPBA400S* Series, Bronze Body. (FP)

Watts: LFB6080G2-SS*, Brass Body. (FP)

*Provide stem extensions on valves where pipe insulation affects the operation of the valve handle.

2. Shut Off Valves for Domestic/Laboratory Water ProPress (Press End) Piping Systems: (Contractor Option)

- a. Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves used for shutoff duty shall be two (2) piece full (FP) port lead free ball valves with brass or bronze valve body with press end smart connections, solid tunnel bore 316 stainless steel vented ball and stem, EPDM or PTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below:

Viega: 2971.3ZL, Bronze Body*

Apolloexpress 77WLF-140*, Bronze Body

Milwaukee: UPBA480S*, Brass Body

*Provide stem extensions on valves where pipe insulation affects the operation of the valve handle.

- b. Piping Systems Two and One Half (2-1/2) inch to Four (4) Inch: All butterfly valves in plumbing piping systems used for shut-off duty shall be lead free bi-directional dead end service general purpose butterfly valves with a lugged ductile iron valve body with full threaded lug connections, Nylon – 11 coated ductile iron disk, 416 stainless steel stem, EPDM double seal seats and seals, for gear operator, hand wheel or chain operation. All valves shall be ANSI Class 150, MSS-SP68 face to face dimension. Valve model numbers shall be as listed below:

Bray/McCannalok - Series 31H with Trim 390*
Milwaukee – HL Series*

*Chain Operation: Provide chain operators in place of valve handles for shut off valves installed in piping systems ten (10) feet or higher above the finished floor of Mechanical Equipment Rooms. <Delete if not Required >

*Extensions: where necessary provide shaft extensions to allow mounting of the valve operator outside of pipe insulation.

3. Shut Off Valves for Domestic/Laboratory Water Copper Victaulic Piping Systems: (Contractor Option)

- a. Piping Systems Two and One Half (2-1/2) Inch and Larger: All butterfly valves in plumbing piping systems used for shut-off duty shall be lead free bi-directional dead end service general purpose butterfly valves with a lugged ductile iron valve body with full threaded lug connections, Nylon – 11 coated ductile iron disk, 416 stainless steel stem, EPDM double seal seats and seals, for gear operator, hand wheel or chain operation. All valves shall be ANSI Class 150, MSS-SP68 face to face dimension. Valve model numbers shall be as listed below:

Bray - Series 31H with Trim 390*
Milwaukee – HL Series *

*Chain Operation: Provide chain operators in place of valve handles for shut off valves installed in piping systems ten (10) feet or higher above the finished floor of Mechanical Equipment Rooms. <Delete if not Required >

*Extensions: where necessary provide shaft extensions to allow mounting of the valve operator outside of pipe insulation.

4. Drain and Specialty Valves for Domestic/Laboratory Water Piping Systems:

- a. Drain Valves for Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves used as low point drains or for system drain down duty shall be three quarter (3/4) inch two (2) piece full port (FP) lead free valves ball with brass or bronze valve body with threaded end connections, solid tunnel bore 316

stainless steel ball and stem, RPTFE seats and seals, valve lever type handle and three quarter (3/4) inch capped hoses connection. Valve model numbers shall be as listed below:

Apollo: 77FLF-140* Series, Brass Body. (FP)
Milwaukee: UPBA400S* Series, Bronze Body. (FP)
Watts: LFB6080G2-SS*, Brass Body. (FP)

*Provide stem extensions on valves where pipe insulation affects the operation of the valve handle.

- b. Drain Valves for Piping Systems Two and One Half (2-1/2) Inch and Larger: All valves used as low point drains or for system drain down duty shall be two (2) inch two (2) piece full port (FP) lead free ball valves with brass or bronze valve body with threaded end connections, solid tunnel bore 316 stainless steel ball and stem, RPTFE seats and seals, valve lever type handle and two and one half (2-1/2) inch capped hoses connection. Valve model numbers shall be as listed below:

Apollo: 77FLF-140* Series, Brass Body. (FP)
Milwaukee: UPBA400S* Series, Bronze Body. (FP)
Watts: LFB6080G2-SS*, Brass Body. (FP)

- c. Specialty Valves: All specialty valves used for Pressure Gages, P/T Plugs, and DP Switches shall be one quarter (1/4) inch two (2) piece full port (FP) lead free ball valves with brass or bronze valve body with threaded end connections, solid tunnel bore 316 stainless steel ball and stem, RPTFE seats and seals and valve lever type handle. Valve model numbers shall be as listed below:

Apollo: 77FLF-140* Series, Brass Body. (FP)
Milwaukee: UPBA400S* Series, Bronze Body. (FP)
Watts: LFB6080G2-SS*, Brass Body. (FP)

5. Shut Off Valves for Laboratory Specialty Gas Brazed and/or ProPress (Press End) Piping Systems for Compressed Air, Nitrogen, Oxygen, Carbon Monoxide, Argon, and Vacuum:

- a. Brazed Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves in laboratory specialty gas service piping used for shut-off duty shall be full port three (3) piece ball valves with brass or bronze valve body with threaded end connections, stainless steel ball and stem, RPTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below:

Apollo – 82-140 Series
Watts – B6800SS
Milwaukee – BA-300S

- b. Brazed Piping Systems Two and One Half (2-1/2) Inch and Three (3) Inch: All valves in laboratory specialty gas service piping systems used for shut-off duty shall be three (3) piece full port ball valves with brass or bronze valve body with threaded end connections and with six (6) inch long copper tube extensions with male end connections for brazed pipe systems, stainless steel ball and stem, RPTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below:

Apollo – 82-140 Series
Milwaukee – BA-300S

- c. ProPress (Press End) Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves in laboratory specialty gas service piping used for shut-off duty shall be three (3) piece full port ball valves with brass or bronze valve body with thread end connections, 316 stainless steel ball and stem, RPTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below: (Contractor's Option)

Apollo – 82-140 Series***
Watts – B6800SS***
Milwaukee – BA-300S***

*** Provide Viega press end/male threaded end pipe adapters Viega Model 2911ZL for valves installed in ProPress (Press End) Piping Systems.

- d. ProPress (Press End) Piping Systems Two and One Half (2-1/2) Inch and Three (3) Inch: All valves in laboratory specialty gas service piping used for shut-off duty shall be three (3) piece full port ball valves with brass or bronze valve body with thread end connections, 316 stainless steel ball and stem, RPTFE seats and seals, and valve lever type handle. Valve model numbers shall be as listed below: (Contractor's Option)

Apollo – 82-140 Series***
Watts – B6800SS***
Milwaukee – BA-300S***

*** Provide Viega press end/male threaded end pipe adapters Viega Model 2911ZL for valves installed in ProPress (Press End) Piping Systems.

6. Shut Off Valves Laboratory Natural Gas Threaded Piping System:

- a. Piping Systems One Quarter (1/4) Inch to One (1) Inch: All valves in laboratory natural gas piping systems for shut-off duty shall be full port ball valves with brass or bronze valve body, threaded end connections, chrome plated B16 brass ball and stem, RPTFE seats and seals, and valve lever type handle and complying with Gas Approvals ASME B 16.38 and B16.44 and UL Guide “YRPV”. Valve model numbers shall be as listed below:

Apollo – 94A Series
Watts – FBV-3C

- b. Piping Systems One and One Quarter (1-1/4) Inch to Three (3) Inch: All valves in laboratory natural gas piping systems used for shut-off duty shall be full port ball valves with brass or bronze valve body, threaded end connections, chrome plated B16 brass ball and stem, RPTFE seats and seals, and valve lever type handle and complying with Gas Approvals ASME B16.38 and ASME B16.44 and UL Guide “YRPV”. Valve model numbers shall be as listed below:

Apollo – 94A Series
Watts – FBV-3C

7. Shut Off Valves RO/DI PVC or Polypropylene Piping Systems:

- a. Piping Systems One Half (1/2) Inch to Two (2) Inch: Use Full Port PVC or Polypropylene Ball Valves matching the piping systems as follows:

- 1) Spears Ball Valves: Spears LXT quarter turn PVC true union ball valves, full schedule 80 bore to minimize pressure drop, PTFE floating seal design, EDPM ‘O’ ring seals, ‘T’ shear stem, socket and threaded end connections, and true union design for ease of installation and maintenance conforming to the following:

- a) Valve Sizes One Half (1/2) Inch to Two (2) Inch: Maximum pressure rating of 235 psi, non-shock @ 73°F.
b) Valve Sizes Three (3) Inch and Four (4) Inch: Maximum pressure rating of 150 psi, non-shock @ 73°F.

- 2) Diaphragm Valves for RO/DO PVC or Polypropylene Piping Systems One Half (1/2) Inch to Two (2) Inch: Weir type polypropylene body, sanitary ends suitable for clamp type ends, 150 grit interior finish, seal Type 2 polypropylene bonnet, bronze bushings and compressor, EPDM diaphragm, EPDM backing cushion and stainless steel tube nut assembly by the piping system manufacturer.

- 3) Check Valves: Ball type PVC or polypropylene true union check valves suitable for clamp type ends, 150 grit interior finish and Viton ring seal by the piping system manufacturer.
8. Shut Off Valves RO/DI Stainless Steel ProPress (Press End) Piping Systems: (Contractor Option)
 - a. Piping Systems One Half (1/2) Inch to Two (2) Inch: All valves in RO/DI laboratory water piping systems for shut off duty shall be two (2) piece full port lead free valves with 316 stainless steel valve body with press end smart connections, solid tunnel bore 316 stainless steel ball and stem, EPDM seats and seals, and lever type handle. All valves shall be Model 4070 as manufactured by Viega.

B. Balancing Valves – Domestic/Laboratory Hot Water Recirculating Systems:

1. Balancing valves shall be by one (1) of the following manufacturers:
 - a. Griswold Controls: Provide Griswold lead free ‘K’ balancing valves, one half (1/2) inch through one and one half (1-1/2) inch where indicated on the drawings, details and diagrams. Valve assembly shall include a lead free brass body, female NPT end connections, EPDM ‘O’ ring seals, P/T body tapings, AISI type 17-7 PH cartridge and a stainless steel 20 mesh strainer.
 - b. Bell & Gossett: Provide Bell & Gossett balancing valves, one half (1/2) inch through one and one half (1-1/2) inch, where indicated on the drawings, details, and diagrams. Valve assembly shall include a lead free brass body, NPT end connections, stainless steel ball valve, integral readout ports, memory stop screw/button, drain purge connection, calibrated name plate and be certified by CSA Group to NSF/ANSI 372 to conform to lead free requirements.

C. Check Valves:

1. Swing Check Valves, two and one half (2-1/2) inches (DN65) and Smaller: MSS SP-80; Class 125, 200-psi (1380-kPa) CWP, or Class 150, 300-psi (2070-kPa) CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded connections for 60 psig steam condensate service.

2.7 HANGERS & SUPPORTS

- A. General: Provide all supports, identification, and testing for all piping systems indicated on the drawings, details and as specified below.

B. Interior Pipe System Hangers & Supports:

1. Hangers and supports shall be provided for all piping systems, as recommended by the hanger manufacturers for the existing structural elements. On piping systems requiring insulation, hangers and supports shall be installed external to the insulation material, and sheet metal saddles shall be provided. Hangers and supports shall be provided at all changes of direction and elevations on piping system. Spacing shall be as recommended by manufacturer, for each pipe size and material.
2. Hangers, Supports, and Components: Provide factory fabricated products according to MSS SP-58 as manufactured by B-Line, Fee and Mason, ITT Grinnel, Pipe Shields, Inc., Michigan Hanger, and Unistrut. Unless otherwise indicated, specified model numbers are manufactured by B-Line.
3. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
4. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
5. Thermal Hanger Shield Inserts: 100-psi (690kPa) average compressive strength, waterproofed calcium silicate or treated lumber inserts, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.
6. Horizontal Non-Insulated Waste, Vent and Storm Water Piping Hangers:
 - a. Two (2) inch and smaller: Figure No. B3170.
 - b. Two and one-half (2-1/2) inch and larger: Figure No. B3100.
7. Insulated Horizontal Piping Hangers: Cold and Hot Water (Domestic), Chilled Water, Condenser Water, Steam and Condensate Return, Reheat Water, Glycol Solution, Heating Hot Water:
 - a. Two (2) inch and smaller: Figure No. B3108, with metal shield, Figure No. B3151.
 - b. Two and one-half (2-1/2) inch and larger: Figure No. B3108, with metal shield, Figure No. B3151.
8. Vertical Piping Riser Clamps:
 - a. Copper Pipe: Figure No. B3373CT.
 - b. Steel Pipe: Figure No. B3136 and B3137.

2.8 IDENTIFICATION SYSTEM

- A. General Requirements: Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125°F (52°C) or higher.
- B. Identification Products for Plumbing Systems: Identification products for Plumbing Systems shall include pipe markers, duct markers, valve tags and ceiling markers conforming to ANSI/ASME A 13.1 & OSHA requirements for letter/color combinations and as follows:
1. Pipe Labels: Provide pretensioned, preformed semi-rigid vinyl or plastic pipe labels with flow arrows to partially cover or cover full circumference of pipe and to attach to pipe without adhesive. Pipe labels shall be SETMARK System as manufactured by Seton Name Plate Corporation or approved equal.
 - a. Label Material: Comply with the following:
 - 1) Vinyl Formed Labels:
 - a) External diameters up to two (2) inches – 20 mil vinyl.
 - b) External diameters up to two and one half (2-1/2) inches – 30 mil vinyl.
 - 2) Plastic Formed Labels: per manufacturer’s recommendations.
 - b. Label Contents: Text with Field/Letters color as noted below:
<Edit for Project>
 - 1) “SANITARY” – Green/White
 - 2) “VENT” – Green/White
 - 3) “ACID WASTE” – Green/White
 - 4) “ACID WASTE VENT” – Green/White
 - 5) “DOMESTIC COLD WATER” – Blue/White
 - 6) “DOMESTIC HOT WATER” – Blue/White
 - 7) “DOMESTIC HOT WATER RETURN” – Blue/White
 - 8) “LABORATORY COLD WATER” – Blue/White
 - 9) “LABORATORY HOT WATER” – Blue/White
 - 10) “LABORATORY HOT WATER RETURN”
 - 11) “LABORATORY COMP AIR” – Green/White
 - 12) “LABORATORY VACUUM” – Green/White
 - 13) “LABORATORY NATURAL GAS” – Green/White
 - 14) “LABORATORY CO2” – Green/White
 - 15) “LABORATORY RO/DI WATER” – Blue/White
 2. Valve Tags: <Edit for Project>
 - a. Description: Stamped or engraved with one quarter (1/4) inch letters for piping system abbreviation and one half (1/2) inch numbers with:

- 1) Brass Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2) Fasteners: Brass wire-link chain.
 - 3) Astric ((*): Indicates the valve is part of a renovation project in the building.
- b. Plumbing: Service – Tag Data:
- 1) Domestic Cold Water – *DCW
 - 2) Domestic Hot Water – *DHW
 - 3) Laboratory RO / DI Water – *LRODIW
 - 4) Laboratory Cold Water – *LCW
 - 5) Laboratory Hot Water – *LHW
 - 6) Laboratory Compressed Air – *LCA
 - 7) Laboratory Natural Gas – *LNG
 - 8) Laboratory Vacuum – *LVAC
 - 9) Laboratory Oxygen – *LOXY
 - 10) Laboratory Nitrogen – *LNIT
 - 11) Laboratory Nitrous Oxide – *LNO
 - 12) Laboratory Carbon Dioxide – *LCD
3. Ceiling Markers: Ceiling Grid and Access Panel Markers: Provide Kroy type clear adhesive printed labels with three sixteenth (3/16) inch high letters to identify the location of concealed valves and equipment. <Edit for Project>
- a. Ceiling Marker Data: For Plumbing Systems include:
- 1) System Valves: Identify as follows:
 - a) Domestic Cold Water – “Plumbing Valve – HWRS”
 - b) Domestic Hot Water – “Plumbing Valve – HWRR”
 - c) Laboratory Compressed Air – “Plumbing Valve – PCWS”
 - d) Laboratory Vacuum – “Plumbing Valve – PCWR”
 - e) Laboratory Natural Gas – “Plumbing Valve – PCWR”
 - f) Laboratory CO₂ – “Plumbing Valve – PCWR”
 - g) Laboratory RO/DI – “Plumbing Valve – PCWR”
 - h) Plumbing Low Point Drains – “Plumbing LPD – (*)
(* = DCW, DHW, LCW, LHW, RO/DI)
 - 2) Miscellaneous Items: Identify as follows:
 - a) Sanitary Waste Cleanout – “SANCO”
 - b) Laboratory Waste Cleanout – “LABCO”
 - c) Storm Water Cleanout – “SWCO”

2.9 PLUMBING FIXTURES

A. General:

1. Provide all plumbing fixtures and specialties indicated on the drawings and as specified below, complete with all trim, hangers, fittings etc. for a complete installation. All exposed metal parts shall be polished chrome plated brass unless otherwise specified below.
2. All plumbing fixtures & trim shall be as specified or approval equal.

B. Plumbing Fixtures:

1. P-1 Water Closets: American Standard Afwall wall hung water closet 2257.101 white vitreous china siphon jet, 1.6 gallon per flush, elongated bowl, one and one-half (1-1/2) inch top spud; or equivalent by Crane, Elger, or Kohler, Sloan Royal 110-3YB flush valve with vacuum breaker or equivalent by Josam or Zurn, one (1) inch screw driver angle stop and flush connection; Olsonite #95 white open front seat; and chair carriers and fittings as manufactured by Josam, Zurn or Smith. Mounting height from finished floor to rim shall be fifteen (15) inches.

Trap Primer - For each floor drain within the restroom, provide a Sloan Vacuum Breaker VBF-72-A1 Trap primer chrome plated flush connection with a special three eights (3/8) inch adaptor connection from the flushometer outlet, for a flex-bend connection, and a wall flange, for each floor drain. Trap primer shall be as manufactured by Sloan on approved equal.

2. P-1A Water Closets: American Standard Afwall wall hung water closet 2257.101 white vitreous china siphon jet, 1.6 gallon per flush, elongated bowl, one and one-half (1-1/2) inch top spud; or equivalent by Crane, Elger, or Kohler, Sloan Royal 110-3YB flush valve with vacuum breaker or equivalent by Josam or Zurn, one (1) inch screw driver angle stop and flush connection; Olsonite #95 white open front seat; and chair carriers and fittings as manufactured by Josam, Zurn or Smith. Mounting height from finished floor to rim shall be seventeen (17) inches.

Trap Primer - For each floor drain within the restroom, provide a Sloan Vacuum Breaker VBF-72-A1 Trap primer chrome plated flush connection with a special three eights (3/8) inch adaptor connection from the flushometer outlet, for a flex-bend connection, and a wall flange, for each floor drain. Trap primer shall be as manufactured by Sloan on approved equal.

3. P-1B Water Closets: American Standard Madera FlowWise Model 2234.001 floor mounted water closet, elongated bowl, one and one-half (1-

- 1/2) inch top spud; and bolt caps or equivalent by Crane, Elger, or Kohler, Sloan Royal 110-3YB flush valve with vacuum breaker or equivalent by Josam or Zurn, one (1) inch screwdriver angle stop and flush connection; Olsonite #95 white open front seat. Rough in: Ten (10) inches or twelve (12) inches.
4. P-2 Urinals: American Standard Washbrook wall hung urinal 6501.511 white vitreous china, one (1) gallon per flush, washout urinal; three quarter (3/4) inch top spud; two (2) inch outlet; Sloan Royal 180 YB flush valve with vacuum breaker; one (1) inch screwdriver angle stop and flush connection; and wall hanger. Mounting height from finished floor to rim shall be twenty four (24) inches.
 5. P-2A Urinals: (Handicapped) American Standard Washbrook wall hung urinal 6501.511 white vitreous china, one (1) gallon per flush, washout urinal; three quarter (3/4) inch top spud; two (2) inch outlet; Sloan Royal 180 YB flush valve with vacuum breaker; one (1) inch screwdriver angle stop and flush connection; and wall hanger. Mounting height from finished floor to rim shall be seventeen (17) inches.
 6. P-3 Lavatory Wall Hung Sink: American Standard Lucerne wall hung 0356.421 white vitreous china laboratory, 25 inch x 18 inch bowl, faucet ledge with single center faucet hole, front over flow, wall hanger and fitted Sloan Optima Sensor Faucet Assembly, Model EAF-150-BAT-CP-1.0 GPM-AER-IR-IQ-FCT with hot and cold water supplies, chrome strainer, one and one-half (1- 1/2) inch cast brass 'P' trap with cleanout, three eights (3/8) inch supply stops with lead free angle valves and wall type escutcheon plates for supply stops and drain.
 7. P-3A Lavatory Wall Hung Sink: (Handicapped): American Standard Lucerne wall hung 0356.421 white vitreous china laboratory, 25 x 18 bowl, faucet ledge with single center faucet hole, front over flow, wall hanger and fitted with a Sloan Optima Sensor Faucet Assembly, Model EAF-150-BAT-CP-1.0 GPM-AER-IR-IQ-FCT with hot and cold water supplies, chrome strainer, one and one-half (1- 1/2) inch cast brass 'P' trap with cleanout, three eights (3/8) inch supply stops with lead free angle valves and wall type escutcheon plates for supply stops and drain. Mounting height from finished floor to rim shall be thirty four (34) inches. Insulate all exposed piping below fixture.
 8. P-4 Countertop Lavatory: American Standard Aqualyn 0475.047 white vitreous china self rimming countertop lavatory, faucet ledge with single center faucet hole, front over flow, mounting kit, and fitted with a Sloan Optima Sensor Faucet Assembly, Model EAF-150-BAT-CP-1.0 GPM-AER-IR-IQ-FCT with hot and cold water supplies, chrome strainer, one and

one-half (1-1/2) inch cast brass 'P' trap with cleanout, three eighths (3/8) inch supply stops with lead free angle valves and wall type escutcheon plates for supply stops and drain.

9. P-5 Mop Sink: Fiat Model MSB-2424, twenty four (24) inch x twenty four (24) inch x ten (10) inch high white molded stone mop service basin fitted with the following accessories:

Basin Drain: Model 1453 BB stainless steel strainer and drain body with a QDC-3 joint to a three (3) inch drain pipe. A combination dome strainer and lint basket made from stainless steel shall be included.

Hose: Model No. 832 - AA heavy duty hose and bracket thirty (30) inch long flexible, heavy duty five eighth (5/8) inch rubber hose, cloth reinforced with three quarter (3/4) inch brass coupling at one end. Bracket is five (5) inches long x three (3) inches wide, stainless steel with rubber grip.

Hanger: Model No. 889-CC stainless steel mop bracket twenty four (24) inches long x three (3) inches wide with three (3) rubber tool grips.

Guard: Model No. E - 77- AA twenty four (24) inch long vinyl bumper guard.

Faucet Assembly: In addition to the above manufacturer's accessories provide the following:

Mixing Faucet: T&S Brass BA-0665-BSTR wall mount mixing faucet with rough chrome plated brass body, rough chrome plated brass spout with vacuum breaker, pail hook and garden hose male outlet, compression cartridges with spring checks, lever handles, 1/2" NPT female inlets, upper support rod and built-in service stops. Certified to ASME A112.18.1/CSA B125.1, NSF 61 - Section 9, NSF 372 and ASSE 1001. Meets ADA ANSI/ICC A117.1 requirements.

10. P-6 Bottle Filling Station: Barrier Free wall hung electric air cooled unit shall deliver 8.0 GPH of 50°F chilled drinking water at 90°F ambient air and 80°F inlet water. The water cooler unit shall have a flex guard safety bubbler with push bar activation and a stainless steel basin with an integral drain and a galvanized structural steel chassis. Bottle filler unit shall include an electronic sensor for touchless activation for filling bottles at a rate of 1 to 1.5 GPM with a twenty (20) second shut off timer and a stainless steel bottle filler wrap with ABS plastic alcove. Each unit shall

include integrated silver ion anti-microbial protection in key areas, meet ADA Guidelines, be certified to UL399 and CAN/CSA 22.2, #120, meet State and Federal lead free requirements and comply with NSF/ANSI 61 and 372. Finish for each unit shall be Light Gray Granite. Bottle Filling Stations shall be either a single wall unit or a bi-level modular unit as manufactured by Elkay (Basis of Design) or approved equal by Oasis or Halsey Taylor. Elkay model numbers are as follows:

Single Wall Mounted Unit: Single Unit provide Elkay Model EZS8WSLK bottle filling station with <Insert value> HP compressor, 5.0 FLA, 370 rated watts, and 120 volt, 60 hertz, single phrase.

< Oasis Model PG8SBF, Halsey Taylor Model HTHB-HVRGRN8-NF >

Bi-Level Modular Unit: Bi-Level Unit provide Elkay Model EZSTL8WSLK (left hand high) with electric water cooler and a bottle filling station with <Insert value> HP compressor, 7.0 FLA, 360 rated watts, and 120 volt, 60 hertz, single phrase.

< Oasis Model PG8SBFSL, Halsey Taylor Model HTHB-HVRGRN8BL-NF >

< Engineer to coordinate type of unit with architect and choose one of the above and edit for project.>

<Engineer Note: Bi Level (left hand high) means the cooler unit is mounted high to the left of the bottle filler section.>

Each bottle filling station shall include a cooling system as follows:

Cooling System: Cooling system shall include the following:

Compressor: Compressor shall be a hermetically sealed reciprocating type single phase compressor with sealed in lifetime lubrication.

Condenser: Condenser shall have copper tubes with aluminum fins and have a cooling fan with a permanently lubricated motor.

Cooling Unit: cooling unit shall be a combination tube-tank type unit with a continuous copper tubing and stainless steel tank, fully insulated with EPS foam which meets UL requirements for self-extinguishing material.

Refrigerant Type and Control: Refrigerant shall be R134a and is controlled by accurately calibrated capillary tube.

Temperature Control: Temperature control shall be by a unit mounted adjustable thermostat accessible through the panel.

Field Accessory: Provide one and one-half (1-1/2) inch cast brass 'P' trap.

11. P-7 Laboratory Countertop Sink: Just Model # SLX-2225-A-GR, single compartment, stainless steel countertop sink with overall dimension of 22 inches wide x 25 inches long and a 16 inch wide x 22 inch long x 10-1/2

inch deep bowl and a faucet ledge with a single center hole punch. Each sink shall be fitted with the hardware specified below. All sink hardware shall be as manufactured by Chicago Faucet, T&S Brass, Bradley, Speakman, or Plastic Piping System (PPS). Model #s listed below are for Chicago Faucet, Bradley & PPS.

Laboratory Sink Hardware:

Faucet Assembly - LWM1-B03-F rigid/swing gooseneck spout with vacuum breaker, E7 serrated nozzle, by Chicago Faucet. Option: T&S Brass Model BL5704 - 08W4 modified for a nine (9) inch long nozzle w/ serrated tip.

Supply Stops - #10/8 three eighth (3/8) inch supply risers twelve (12) inches long with three eighth (3/8) inches lead free angle valves with wheel handle.

P-Trap & Drain - Acid waste drain #W1021, one and one-half (1- 1/2) inch P trap with #W301 threaded sink outlet, by PPS.

Eye Wash - Bradley Model #S-19-465EFW, ANSI Z358.1-2009, handheld deck mounted eyewash/face spray with dual angled nozzles with protected covers, valve with extended handle, deck flange with under counter guide and Bradley #S45-2309 vacuum breaker or equal by Water Saver Faucet Co. Model EW1022.

RO/DI Faucet - Non-Recirculating Laboratory Gooseneck Faucet shall be unpigmented natural polypropylene type with threaded inlet and under deck clamp, serrated tip, integral vacuum breaker, one half (1/2) inch male threads and valve where indicated on the construction documents. The Non-Recirculating Laboratory Gooseneck Faucets shall be as manufactured by Plastinetics Model/Part QP1200299 – 001 or Harrington/Saint-Gobain Plastics Model/Part GT132893B-08M. Provide a shut-off valve below countertop at point of rough in or above the ceiling. See Pipes, Valves, Fittings and Specialties for valve applications. Coordinate all required plumbing.

12. P-8 Epoxy Laboratory Sinks – Epoxy laboratory sinks shall be furnished with case work. Each sink shall be fitted with the hardware specified below.

All sink hardware shall be as manufactured by Chicago Faucet, T&S Brass, Bradley, Speakman, or Plastic Piping System (PPS). Model #s listed below are for Chicago Faucet, Bradley & PPS.

Epoxy Laboratory Sink Hardware:

Faucet Assembly - LWM1-B03-F rigid/swing gooseneck spout with vacuum breaker, E7 serrated nozzle, by Chicago Faucet. Option: T&S Brass Model BL5704 - 08W4 modified for a nine (9) inch long nozzle w/ serrated tip.

Supply Stops - #10/8 three eight (3/8) inch supply risers twelve (12) inches long with three eight (3/8) inches lead free angle valves with wheel handle.

P-Trap & Drain - Acid waste drain #W1021, one and one-half (1-1/2) inch P trap with #W301 threaded sink outlet, by PPS.

Eye Wash - Bradley Model #S-19-465EFW, ANSI Z358.1-2009, handheld deck mounted eyewash/face spray with dual angled nozzles with protected covers, valve with extended handle, deck flange with under counter guide and Bradley #S45-2309 vacuum breaker or equal by Water Saver Faucet Co. Model EW1022.

13. P-9 Laboratory Cup Sinks: Laboratory cup sinks shall be furnished with the case work. Provide rough-in and final connections for laboratory acid waste, vent and domestic water as required and/or as indicated on the drawings. All cup sink hardware shall be as manufactured by Chicago Faucet, T&S Brass, Bradley, Speakman, or Plastic Piping System (PPS). Model #s listed below are for Chicago Faucet & PPS.

Laboratory Cup Sink Hardware:

Faucet Assembly - #928-CP single rigid/swing gooseneck spout with vacuum breaker, E7 aerator by Chicago Faucet.

Supply Stops - #10/8 three eight (3/8) inch supply risers twelve (12) inches long with three eight (3/8) inch lead free angle valves with wheel handle.

P-Trap & Drain - Acid waste drain #W1021, one and one-half (1-1/2) inch P trap with #W301 threaded sink outlet, by PPS.

14. P-10 Non Laboratory Countertop Sink: Just Model ##LLQ-17519-B-GR, single compartment, stainless steel countertop sinks with overall dimension of 17 1/2 inches wide x 19 inches long with a 11 1/2 inch wide x 16 inch long x 6 inch deep bowl and a faucet ledge with faucet holes punched on eight (8) inch centers. Each sink shall be fitted with the hardware specified below. All sink hardware shall be as manufactured by Chicago Faucet, T&S Brass, Bradley, Speakman, or Plastic Piping System (PPS). Model #s listed below are for Chicago Faucet, Bradley & PPS.

Non Laboratory Countertop Sink Hardware:

Faucet Assembly - #786-GN2FC319ABCP rigid/swing gooseneck spout, wrist blade handles, eight (8) inch centers, chrome finish with aerator, by Chicago Faucet.

Supply Stops - #10/8 three eight (3/8) inch supply risers twelve (12) inches long with three eight (3/8) inch lead free angle valves with wheel handle.

P-Trap & Drain - Acid waste drain #W1021, one and one-half (1-1/2) inch P trap with #W301 threaded sink outlet, by PPS.

15. P-11 Wall Hung Sink: Just Manufacturing Company Model A-33338 wall hung 20 inch x 18 inch sink, seamless welded construction, fabricated of 18 gauge type 304 stainless steel, with integral-formed apron, connected overflow and backsplash. All exposed surfaces shall be polished. Underside of sink assembly shall be coated to insulate for sound and condensation reduction. Provide a center punch for a standard lavatory drain. Provide one stainless steel wall clip with integral flange for wall mounting. Provide faucet ledge with eight (8) inch centers, for faucet assembly specified below.

Wall Hung Sink Hardware:

Faucet Assembly - Just Model J-1174-KS faucet assembly cast brass construction, six (6) inch wrist blades, water saving aerator, & swivel gooseneck. All exposed parts shall have a polished chrome finish.

Supply Stops - T & S Brass B1341 lead free angle stop valves with wheel handle for three eights (3/8) inch brass chrome plated supply risers, lengths to suit installation requirements.

- P-Trap & Drain - Acid waste drain #W1021, one and one-half (1-1/2) inch P trap with #W301 threaded sink outlet, by PPS.
16. P-12 Laboratory Bar Sink: Just Model SBL-1812-A-GR, single compartment, stainless steel countertop sink with an overall dimension of 18 inches long x 12 inches wide and a 12 inch long x 9 inch wide x 6 inch deep bowl. The sink shall be seamless welded construction, fabricated with 18 gauge; type 304 stainless steel. All exposed surfaces shall be polished. Underside of sink assembly shall be coated to insulate for sound and condensation reduction. Provide a center punch for a standard lavatory drain. Provide one stainless steel wall clip with integral flange for wall mounting. Provide faucet ledge with a single centered hole, for faucet assembly specified below.
- Laboratory Bar Sink Hardware:
- Faucet Assembly - Just Model JGN-740 bar and pantry faucet assembly cast brass construction; die cast lever handles, water saving aerator, & swivel gooseneck. All exposed parts shall have a polished chrome finish.
- Supply Stops - T & S Brass B1341 lead free angle stop valves with wheel handle for three eight (3/8) inch brass chrome plated supply risers, lengths to suit installation requirements.
- P-Trap & Drain - Acid waste drain #W1021, one and one-half (1-1/2) inch P trap with #W301 threaded sink outlet, by PPS.
- Vacuum Breaker - Watts model NLF-9 vacuum breaker at the faucet outlet with a polished chrome finish.
17. P-13 Emergency Shower: Bradley model S19-130A, ceiling mounted emergency shower complete with ten (10) inch diameter stainless steel shower head, one (1) inch IPS chrome plated brass stay-open ball valve operated by a stainless steel pull rod with triangular handle, galvanized pipe and fittings and fourteen (14) inch x three and one half (3-1/2) inch aluminum identification sign suitable for wall mounting. Minimum inlet water pressure 10 psi. If piping is exposed provide chrome plated brass piping.
18. P-14 Fume Hood: Contractor shall provide rough-in and final connections for laboratory, acid waste, vent, air, natural gas, vacuum and domestic water as required and/or as indicated on the drawings. For each cup sink provide an Enfield model W1021 P-trap.

19. P-15 Bio Safety Cabinet: Contractor shall provide rough-in and final connections for laboratory vacuum as required and/or as indicated on the drawings. Provide accessible shut-off valve for each service. Note: Natural gas connections to Bio Safety Cabinets are not permitted at UMB.

2.10 PLUMBING SPECIALTIES

A. Plumbing Specialties:

1. Laboratory Natural Gas, Compressed Air and Vacuum Outlets:

- a. Tapered Turret Type: Provide tapered turret with ground key hose cock with integral tapered serrated hose tip. The key lock shall be all brass, polished chromium plated finish, plastic color coded index, plastic mounting gasket, supply nipple, & lock nut for deck mounting. Provide the following type and model by T & S or equal by Chicago faucet as follows:
- 1) Single Outlet Type: T&S Model BL-4200-1 for natural gas, compressed air, vacuum service.
 - 2) Double Outlet Type (90° Outlets): T&S Model BL-4200-0 for natural gas, compressed air, and vacuum service.
 - 3) Double Outlet Type (180° Outlets): T&S Model BL-4200-02 for natural gas, compressed air, and vacuum service.
- b. Ground Key Type: Provide ground key hose cock with integral tapered serrated hose tip. All brass polished chromium plated finish, plastic color coded index, three eights (3/8) inch male inlet, & suitable for installation on exposed wall mounted piping. Provide the following type and model by T & S or equal by Chicago faucet as follows:
- 1) Single Outlet Type: T&S Model BL-4000-1 for natural gas, compressed air and vacuum service.
- c. Panel Flange Type: Provide panel flange with ground key hose cock with integral tapered serrated hose tip. The key lock shall be all brass, polished chromium plated finish, plastic color coded index, plastic mounting gasket, for surface mounting. Provide the following type and model by T & S or equal by Chicago faucet as follows:
- 1) Single Outlet Type: T&S Model BL-4250-01 for natural gas, compressed air and vacuum service.

- 2) Double Outlet Type: T&S Model BL-4250-02 for natural gas, compressed air and vacuum service.
2. Laboratory Specialty Gas Outlets:
 - a. Provide needle valve hose cock with chrome plated brass body and handle, serrated tip outlet, special valve packing for specialty gases (N₂/O₂) and 3/8" NPT male inlet.
 - 1) Outlet Type: T & S Model BL - 4010-01 for Nitrogen (N₂) and/or Oxygen (O₂).
 3. Laboratory Gas Zone Valve Box:
 - a. Provide A laboratory gas zone valve box assembly were indicated on the drawings and details. Each valve box shall be model V-BOX-ZVBA-E-01 recessed type box and include a steel box with a front aluminum frame with a clear window as manufactured by AMICO Labs or approved equal. Each box assembly shall be twelve (12) inches wide x four (4) inches deep x ten and one half ((10-1/2) inches high with a twelve and three sixteenth (12-3/16) inch high x thirteen and eleven sixteenth (13-11/16) inch wide front frame.
 - b. The valve box assembly shall be constructed of eighteen (18) gauge steel with two (2) knockout holes on each side for piping, and two (2) adjustable steel mounting brackets. Valve box shall come with a white baked on enamel finish.
 - c. Front frame assembly shall be constructed of anodized aluminum and mounted on the box by #6 – 3/8 tapping screws, and a removable clear window with a pullout ring.
 4. Automatic Switchover Bottled Gas Manifold System: <Coordinate with UMB, Delete if not required>
 - a. Bottled Gas Manifold: The bottled gas manifold system shall be Beacon Medaes Model Number 6-107120-2 wall mounted lifeline automatic switchover manifold or approved equal. The manifold shall accommodate multiple cylinders equally divided into two (2) banks for carbon dioxide gas service at 55 psi delivery pressure. The cylinder banks are arranged in a staggered configuration and provide an uninterrupted supply of gas for the specific gas application. The manifold is cleaned, tested, and prepared for the indicated gas service and constructed in accordance with requirements of the latest edition of NFPA 99 and CGA. The manifold components shall be designed to operate over a temperature range of 32°F through 130°F.

- b. **Manifold Design and Operation:** The manifold design shall include bank regulator, one for each cylinder bank, to initially reduce the cylinder pressure to the two (2) line regulators which control the final line pressure. Both line pressure regulators are in service at all times to maximize flow rates. The manifold operation automatically changes from the depleted primary supply bank to the secondary supply bank without fluctuation in line pressure utilizing dome-bias loading and unloading of the bank regulators. After replacement of the depleted cylinders, the manifold automatically indicates the cylinder bank recently replaced as the secondary supply. Manual resetting of the control panel is not necessary. The manifold includes a line pressure gauge, two (2) cylinder bank pressure gauges (left bank and right bank), and color-coded indicator LED visual indicators for “IN USE” (green), “READY” (yellow), and “EMPTY” (red) for each cylinder bank. The manifold has intermediate and line pressure relief valves that are internally connected to a common vent port, terminating into a one half (1/2) inch FNPT O-ring sealed “zero clearance” union. Master shutoff valves (one for each cylinder bank) are located within the manifold cabinet and both valves are fabricated with metallic seating surfaces. The manifold is designed for placement of four “H” cylinders directly underneath the manifold cabinet. The cabinet enclosure is easily removable by releasing draw latches for component accessibility and the enclosure may be secured from unauthorized access by locking the draw latches (locks provided by others).
- c. **Manifold Accessories:** The manifold accessories shall include high-pressure modular header assemblies with gas specific pigtail-to-header check valves to permit changing of cylinders without gas leakage. Stainless steel flexible pigtails are provided for each cylinder gas connection. A separate power supply is furnished with the manifold to convert 120 VAC to 24 VAC output power and includes dry contacts for two (2) separate, electrically isolated, remote alarm connections. The power supply is housed in a NEMA 3R enclosure with electrical requirements of one (1) amp at 120 VAC, 60Hz, single phase. The manifold is supplied with a three quarter (3/4) inch FNPT O-ring sealed “zero clearance” union outlet. The system also includes a three quarter (3/4) inch full port, three piece, ball-type source shut-off valve with a one eighth (1/8) inch FNPT port. The source valve has a three quarter (3/4) inch NPT attachment to the union outlet and a three quarter (3/4) inch nominal copper (type k) tube for brazing to main supply line.
- d. **Submittal Date:** The submittal date shall include the manifold control panel, wall mounting bracket, pressure gauges, stainless steel pig tail cylinder connections, regulator assemblies, pressure switches, manifold piping and

wall brackets, source shut off valve, power supply assembly, and installation, operation, and service manual.

5. Manual Laboratory Bottled Gas Manifolds: <Coordinate with UMB, Delete if not required>
- a. Carbon Dioxide (CO₂): Provide manual type manifolds for each new group of CO₂ cylinders were indicated on the drawings and details. The manual type manifolds shall be as manufactured by AIRGAS for the following arrangements: <Edit for Project Requirements>
- 1) Two (2) Cylinders: Model Y11 CP720B320, with two (2) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 2) Four (4) Cylinders: Model Y11 CP740B320 with four (4) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 3) Six (6) Cylinders: Model Y11 CP760B320 with six (6) thirty six (36) inch long stainless steel pigtail connections with check valves.
- b. Nitrogen (N₂): Provide manual type manifolds for each new group of N₂ cylinders were indicated on the drawings and details. The manual type manifolds shall be as manufactured by AIRGAS for the following arrangements: <Edit For Project Requirements >
- 1) Two (2) Cylinders: Model Y11 CP720B580, with two (2) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 2) Four (4) Cylinders: Model Y11 CP740B580 with four (4) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 3) Six (6) Cylinders: Model Y11 CP760B580 with six (6) thirty six (36) inch long stainless steel pigtail connections with check valves.
- c. Oxygen (O₂): Provide manual type manifolds for each new group of O₂ cylinders were indicated on the drawings and details. The manual type manifolds shall be as manufactured by AIRGAS for the following arrangements: <Edit For Project Requirements >
- 1) Two (2) Cylinders: Model Y11 CP720B540, with two (2) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 2) Four (4) Cylinders: Model Y11 CP740B540 with four (4) thirty six (36) inch long stainless steel pigtail connections with check valves
 - 3) Six (6) Cylinders: Model Y11 CP760B540 with six (6) thirty six (36) inch long stainless steel pigtail connections with check valves.
- d. The bottled gas cylinders shall be supplied and installed by others.
- B. Floor Drains: Floor drains shall be as manufactured by Zurn, Josam, Wade or approved equal as follows:

1. Toilet Rooms: Zurn floor drain Z-415, dura coated cast iron body with no hub type, three (3) inch outlet, combination invertible membrane clamps, adjustable type 'B' six (6) inch diameter nickel bronze strainer, trap primer connection located in the outlet pipe and a no hub type deep seal trap. See drawings and details for pipe size. Trap primer connections located in the drain body are not permitted.
 2. Where indicated on the drawings provide a connection for a trap primer line. The trap primer connection shall be located in the floor drain discharge pipe. Trap primer connections located in the body of the drain are not acceptable.
- C. Trap Primers: For floor drains connected to sanitary piping provide trap primers as follows:
1. Toilet Rooms: Prime the floor drain trap from one of the flush valves serving a water closet.
 2. Non Toilet Room Areas: Prime the floor drain trap using an automatic priming system similar to Precision Plumbing Products Model MP-500-12V battery operated trap primer mounted in a NEMA 1 UL 50, 16 gauge steel box with a screw on cover and a preset timer that opens once every ten (10) seconds every twenty four (24) hours. For applications serving more than one (1) floor drain provide a distribution unit for the trap primer lines. This trap primer system is not acceptable for mechanical equipment rooms. <Coordinate with UMB or if not required delete.>
- D. Cleanouts:
1. General: Provide cleanouts in drainage piping were indicated on the drawings and where required by code, cleanouts shall be same size as pipe in which they are located. Cleanouts in acid waste piping systems shall match piping specified.
 2. Cleanouts: Cleanouts for drainage piping, other than acid waste piping, shall be as follows:
 - a. Finished Floors: Zurn Series ZN - 1400 Dura Coated cast iron body with tapered threaded plug style to suit floor finish with recessed top for tile or carpet, or comparable product.
 - b. Walls: provide Zurn Model No. ZN-1440-1 style to suit all finishes with vandal proof screws, or comparable product.
 - c. Cast Iron Piping: provide Zurn Model No. ZN-1450-7 with bronze plug, or comparable product.

- d. Acid Waste Piping: Cleanouts for acid waste piping to match acid waste piping material.
3. Access Covers / Doors: Where cleanouts are located either behind partitions or flush with finished floor provide access covers or access doors with smooth finish and securing screws.

2.11 PLUMBING EQUIPMENT <Edit for Project or Delete if not required>

A. Commercial Electric Hot Water Heater:

1. General: The heater shall be a glass-lined Custom Xi™ commercial electric heater Model DSE - X with [X] gallons storage, as manufactured by A.O. Smith or approved equal.
2. Heater: Heater should be rated at [X] kW, [X] volts, [X] phase, 60 cycle AC and constructed in accordance with ASME Code, shall bear appropriate symbol and be listed with the National Board as required. Heater shall be listed with Underwriters' Laboratories and classified to The National Sanitation Foundation Standard No. 5.
3. Tank: All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1,600°F. Tank shall be cathodically protected with a combination of sacrificial and powered anodes. The entire vessel is to be enclosed in a round steel enclosure with baked enamel finish.
4. Insulation: Foam insulation shall meet the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.
5. Controls: Water heater shall have an electronic control with large LCD displaying current water heater status; provide real time element status and sensing, low water cutoff and economy mode operation.
 - a. Provide a 120 volt control circuit transformer, transformer fusing, magnetic contactor(s), element fusing per N.E.C., and commercial grade Incoloy elements.
 - b. Temperature controls include limiting switch which will require resetting manually in the event the temperature reaches 202°F.
 - c. The Operating Set Point shall be adjustable from 90°F/42°C to 190°F/88°C. The factory setting is 120°F/49°C.

6. Relief and Drain Valves: Heater shall include a CSA Certified and ASME Rated T&P relief valve and a drain valve.
 7. BAS Interface: Water heater units(s) shall be compatible with building management systems using [Modbus] or [BACnet] with optional ICC interface.
- B. In-Line Circulating Pumps: <Delete if not applicable to this project>
1. General: Provide lead free in-line, separately coupled or close coupled centrifugal Pumps were indicated on the drawings, as manufactured by TACO or approved equal. All pumps labeled as lead free (LF) shall be Lead Free Certified per NSF/ANSI 61 and NSF/ANSI 372. See drawings for model number and capacity.
 2. Description: Factory-assembled and tested, lead free in-line, single-stage, separately coupled or close coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shafts mounted horizontally.
 3. Pump Construction: Pump construction shall be either all low lead brass construction or stainless steel.

2.12 PIPE INSULATION

A. General:

1. All pipe and duct systems shall be insulated with Owens Corning Insulation Products or approved equal by John Manville, Knauf Inc. or Pittsburgh Corning Corp. Foamglas.
2. Provide Tapes, Adhesives, Mastics and Sealants that are compatible with and approved by the insulation manufacturer.
3. Plumbing Piping Systems include the following:
 - a. Handicapped Fixtures: Sanitary Drains and Traps
 - b. Storm Water Systems: Includes horizontal storm water piping above ground exposed and concealed in the building.
 - c. Domestic Plumbing Systems: Cold Water, Hot Water & Hot Water Recirculating Systems (40°F to 110°F) serving non laboratory fixtures.
 - d. Laboratory Plumbing Systems: Cold Water, Hot Water & Hot Water Recirculating Systems (40°F to 110°F) serving laboratory fixtures.
 - e. HVAC Make Up Water Systems: Cold Water Piping providing make up water for Hydronic HVAC Systems.

B. Piping Systems:

1. Handicapped Fixtures:
 - a. Exposed Drains and Traps: Insulation for pipe sizes one half (1/2) inch to one and one half (1-1/2) inches shall comply with the following:
 - 1) Material: Flexible Elastomeric
 - 2) Thickness: One half (1/2) inch
 - 3) Vapor Barrier: Yes
 - 4) Field Applied Jacket – Concealed: None
 - 5) Field Applied Jacket – MER Exposed: None
 - 6) Field Applied jacket – Non MER Exposed: None
2. Storm Water Piping Systems:
 - a. Concealed and Exposed Interior Horizontal Storm Water Piping and Sump Drain: Insulation for all pipe sizes shall comply with the following:
 - 1) Material: Fiberglass
 - 2) Thickness: One and one half (1-1/2) inch
 - 3) Vapor Barrier: No
 - 4) Field Applied Jacket – Concealed: None
 - 5) Field Applied Jacket – MER Exposed: ASJ
 - 6) Field Applied jacket – Non MER Exposed: ASJ
 - 7) Pipe Fittings: “Zeston” pre molded fittings.
3. Domestic Water/Laboratory Piping Systems:
 - a. Concealed and Exposed Interior Domestic/Laboratory Water Piping: Insulation for pipe sizes one half (1/2) inch to one and one half (1-1/2) inches shall comply with the following:
 - 1) Material: Fiberglass
 - 2) Thickness: One (1) inch
 - 3) Vapor Barrier: Yes, cold water only.
 - 4) Field Applied Jacket – Concealed: None
 - 5) Field Applied Jacket – MER Exposed: Glass Cloth
 - 6) Field Applied jacket – Non MER Exposed: PVC
 - 7) Pipe Fittings: “Zeston” pre molded fittings.
 - b. Concealed and Exposed Interior Domestic/Laboratory Water Piping: Insulation for pipe sizes two (2) inch and larger shall comply with the following:
 - 1) Material: Fiberglass
 - 2) Thickness: One and one half (1-1/2) inch
 - 3) Vapor Barrier: Yes, cold water only.
 - 4) Field Applied Jacket – Concealed: None
 - 5) Field Applied Jacket – MER Exposed: Glass Cloth
 - 6) Field Applied jacket – Non MER Exposed: PVC

- 7) Pipe Fittings: “Zeston” pre molded fittings.
- c. Concealed and Exposed HVAC Make Up Water Piping: Insulation for pipe sizes one half (1/2) inch and larger shall comply with the following:
- 1) Material: Fiberglass
 - 2) Thickness: One (1) inch
 - 3) Vapor Barrier: Yes
 - 4) Field Applied Jacket – Concealed: None
 - 5) Field Applied Jacket – MER Exposed: Glass Cloth
 - 6) Field Applied jacket – Non MER Exposed: PVC
 - 7) Pipe Fittings: “Zeston” pre molded fittings.

2.13 FLUSHING AND DISINFECTING POTABLE WATER SYSTEMS

<Coordinate with UMB for Edits>

- A. General: Subject to compliance with requirements, provide the services of one (1) of the following:
1. Bolan Trane.
- B. Disinfecting Solution: The disinfecting solution shall be a concentration of fifty (50) parts per million water-chlorine solution mixture.

2.14 PROJECT OPERATION AND MAINTENANCE MANUAL ELECTRONIC FILES

- A. Project O & M Manual File: The project OM Manual shall include one (1) electronic copy of each approved submittal and any manufacturer’s maintenance manuals, and all warranty certificates included this Division. Also include the address, phone number and contact person for each supplier. Using the UMB Standard O&M Manual Template referenced in Division 01 Closeout Procedures insert the submittal files include both a book mark and tree structure for accessing each submittal file in the manual.

2.15 CONCRETE HOUSEKEEPING PADS <Delete if nor Required>

- A. Provide concrete required for housekeeping pads under Division 22 unless otherwise noted.
- B. Concrete shall be 3,500 psi twenty-eight (28) day compressive strength concrete and reinforcement bars as specified in the architectural specifications.

2.16 GROUT <Delete if nor Required>

- A. Grout shall be non-shrink, high strength type, free of iron or chlorides and suitable for use in contact with all metals, without caps or other protective finishes complying with ASTM C 1107, Grade B and the following:

1. Characteristics: Post hardening, volume adjusting, dry, hydraulic cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5,000 psi (34.50MPa), twenty eight (28) day compressive strength.
3. Packaging: Premixed and factory packaged.

2.17 PIPE SYSTEM HYDROSTATIC/LEAK TEST

- A. Pipe System Hydrostatic/Leak Test: The following Pipe Systems shall be Hydrostatically Leak Tested by the contractor. All piping systems shall be proven tight in the presence of UMB Project Engineer prior to installation of insulation, and connection to exist piping systems. Provide all equipment and labor necessary for hydrostatically testing each system for one (1) hour at the minimum pressures as specified herein unless otherwise noted:

1. Domestic water piping 150 psig
2. Lab specialty gas piping 50 psig minimum *
3. Lab air & vacuum piping 50 psig minimum *
4. Lab natural gas piping 50 psig minimum **
5. RO/DI water piping 100 psig

* Cap and fill each system, with oil-free, dry air or dry nitrogen, to pressure of one and one half (1-1/2) times the system operating pressure, but not less than fifty (50) psig. Isolate the test source and let stand for four (4) hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for one (1) hour with no allowable drop in pressure.

** Cap and fill each system, with oil-free, dry nitrogen, to pressure of one and one half (1-1/2) times the system operating pressure, but not less than fifty (50) psig. Isolate the test source and let stand for four (4) hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for one (1) hour with no allowable drop in pressure.

<Delete Pipe Systems Not Applicable to Project>

- B. Systems using Pro-Press piping connectors shall perform a pre-test at 30 psi for 10 minutes. After the hydrostatic test pressure has been applied for ten (10) minutes and with no allowable drop in pressure, the tested system or segment has passed the Pro-Press leak pretest. If after the ten (10) minute test period there is a loss in pressure below the initial test pressure, the test has failed, and the contractor shall examine piping, joints, and connections for leakage. After all leaks have been corrected by tightening, repairing, and/or replacing components as appropriate, the hydrostatic test shall be rescheduled with the University. The test procedure shall be repeated as specified above until there are no leaks and there is no loss in pressure.
- C. Contractors shall use the UMB Standard Hydrostatic/Leak Test Summary Form for recording the leak test results for all pipe systems tested on this Project as follows:

1. Hydrostatic/Leak Test Pipe Systems: See Part 3 for a sample of the UMB Standard Pipe System Leak Test Summary Form.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS – EXECUTION

- A. All construction work that creates excessive noise will not be permitted during normal business hours. See Division 01 Specification Section “Cutting and Patching” for requirements.

3.2 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. When existing plumbing work is removed, all pipes, valves, hangers etc. shall be removed back to the active pipe mains and capped.
- B. Removal and/or relocation of existing services shall be closely coordinated with Facilities Management if they impact adjacent areas which shall remain operational.
- C. While performing connections and alterations to existing plumbing work, the contractor shall take extreme care to protect all existing materials, equipment, casework etc. from dirt, debris, and damage. Any damage caused by the contractor to existing materials, equipment, casework, etc. shall be repaired to UMB's satisfaction and specifications at the contractor's expense.

3.3 CUTTING AND PATCHING

- A. Cutting and patching associated with the work in the existing structure shall be performed a neat and workmanlike manner. Existing surfaces that are damaged by the contractor shall be repaired or provided with new materials to match existing.
- B. Structural members shall not be cut or penetrated. Holes cut through concrete and/or masonry to accommodate new work shall be cut by reciprocating or rotary, non-percussive methods.
- C. Patching of areas disturbed by installation of new work and/or required demolition shall match existing adjacent surfaces as to material, texture and color.

3.4 CUTTING, WELDING, BURNING

- A. Before the contractor and/or any sub-contractor commences any cutting, welding, burning or other type of hot work at UMB, the contractor must request a Hot Work Permit from the UMB Office of the Fire Marshal. Hot Work Permits must be requested online at

<https://www.umaryland.edu/fire-marshall/hot-work-permits/> at least one (1) day before beginning hot work.

- B. The hot work permit copy shall remain on the job site at the hot work location until such work is completed.

3.5 INSTALLATION – PLUMBING PIPING SYSTEMS

A. Waste and Vent and Storm Water Piping Systems:

1. Install all, horizontal and vertical, non waste and storm water piping systems level and parallel to the building walls, and partitions.
2. Install all, horizontal waste, vent and storm water piping systems parallel to the building walls, and partitions with the required minimum slope required by code to provide gravity drainage to the vertical waste, vent and rainwater leaders.
3. Install all, vertical waste, vent and storm water (rainwater leader) piping systems parallel to the building walls, and partitions with the required minimum slope required by code to provide gravity drainage to the vertical waste, vent and rainwater leaders.

B. Domestic / Laboratory Water Piping Systems:

1. Install domestic water piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
2. Install domestic water piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
3. Install domestic water piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
4. Install domestic water piping to permit valve servicing.
5. Install domestic water piping free of sags and bends.
6. Install fittings for changes in direction and branch connections.
7. Install branch pipe connections off the top of the main pipe or on a 45-degree upward angle. Branch connections off the bottom of the main pipes are not acceptable.

C. Laboratory Compressed Air and Vacuum Systems:

1. Install all horizontal and vertical laboratory compressed air and vacuum piping parallel to the building floors, walls, and partitions.
2. Connect laboratory compressed air and branch vacuum piping to mains from top of the main.
3. Where laboratory compressed air and piping connects to outlets mounted on casework coordinate the locations of the branch piping and outlets with the casework installer.
4. Systems shall be purged with oil free dry nitrogen. A high flow purge shall be performed at each outlet. Each outlet shall flow fully until the purge produces no discoloration in a white cloth.

D. Laboratory Specialty Gas Piping Systems and Manifolds:

1. Install all horizontal and vertical laboratory specialty gas piping parallel to the building floors, walls, and partitions in accordance with the requirements in NFPA 99, CGA all other applicable codes.
2. Connect branch bottled gas piping to mains from top of the main.
3. Where piping connects to outlets mounted on casework coordinate the locations of the branch piping and outlets with the casework installer.
4. Install bottled gas manifolds level and plumb, in accordance with manifold manufacturers' written installation instructions, rough in drawings and the requirements in NFPA 99, CGA all other applicable codes.
5. Systems, including the manifold shall be cleaned, tested, and prepared for the indicated gas service and constructed in accordance with requirements of the latest edition of NFPA 99 and CGA.
6. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
7. Install piping in concealed locations unless otherwise indicated.
8. Pipe Joints: Comply with the following:
 - a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- c. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- d. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Laboratory Natural Gas Piping Systems:

1. Preparation:
 - a. Precautions: Before turning off the gas to the premises, or section of piping, turn off all equipment valves. Perform a leakage test as required in this Division to determine that all equipment is turned off in the piping section to be affected.
 - b. Conform to the requirements in NFPA 54, for the prevention of accidental ignition.
2. Installation: Conform to the requirements of NFPA 54 - National Fuel Gas Code.
3. Concealed Locations: Except as specified below, install concealed gas piping in an air-tight conduit constructed of Schedule 40, seamless black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.
 - a. Above Ceiling Locations: Gas piping may be installed in accessible above ceiling spaces (subject to the approval of the authority having jurisdiction), whether or not such spaces are used as a plenum.
 - 1) Valves shall not be located in ceiling plenums.
 - 2) Piping installed in plenums shall be welded.
 - b. Piping in Walls or Partitions: Concealed piping shall not be located in solid walls or partitions. Tubing shall not be run inside hollow walls or partitions unless protected against physical damage. This does not apply to tubing passing through walls or partitions.
 - c. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumb waiter, elevator shaft, in floor construction, and below floor slabs. This does not apply to accessible above ceiling space specified above.
4. Install natural gas piping at a uniform grade of one quarter (1/4) inch in fifteen (15) feet, upward in direction of the risers.

5. Connect branch outlet pipes from the top or sides of horizontal lines, not from the bottom.
6. Pipe Joint Construction:
 - a. Threaded Joints: Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.
7. Flexible pipe connections shall not be permitted. All connections shall be hard piped.
8. Natural Gas Piping System (NGPS) in HSF-3: Where parts of the existing NGPS in HSF-3 require new piping connections comply with the following:
 - a. Piping Two (2) Inch and Smaller: Install a Viega propress adapter with a solder connection on one end and a male threaded connection on the other end.
 - 1) Locate the adapter at least one and one half (1-1/2) pipe diameters away from the nearest pipe coupling and/or fitting.
 - 2) Adapter Solder End: Braze the solder end of the adapter to the NGPS copper pipe in accordance with ANSI LC-4/CSA 6.32.
 - 3) Adapter Threaded End: Provide a short section of black steel pipe with a female thread end on one end and a plan end on the other end. Connect the threaded end to the adapter and connect a carbon steel pipe coupling to the plan end.
 - 4) Prior to brazing the adapter to the copper pipe wrap the nearest coupling and/or fitting with wet towels to prevent damage to the seals.
 - b. Piping Two and One Half (2) Inch and Larger: Install flanged connections to connect new black steel piping to the existing copper piping complying with the following:
 - 1) Locate the solder end flange connection at least one and one half (1-1/2) pipe diameters away from the nearest pipe coupling and/or fitting.
 - 2) Solder End Flange: Braze the solder end of the flange to the NGPS copper pipe in accordance with ANSI LC-4/CSA 6.32.
 - 3) Install an approved gasket material for natural gas between the two flanges.
 - 4) Threaded End Flange: Bolt to solder end flange and gasket. Connect new piping to thread end.
 - 5) Plain End Flange: Bolt to solder end flange and gasket. Connect new piping to plain end with carbon steel fillings. (contractor option)

F. Laboratory Gas Zone Valve Box:

1. Install laboratory gas zone valve box level and plumb, in accordance with box manufacturers' written installation instructions, and rough in drawings.
2. Install the ball valve with the valve handle in a horizontal position so the valve is closed the handle is in a vertical position allowing the removable window to be in place.

G. Bottled Gas Manifold: <Delete if not required>

1. Install bottled gas manifolds level and plumb, in accordance with manifold manufacturers' written installation instructions, rough in drawings and the requirements in NFPA 99, CGA all other applicable codes.
2. The manifold shall be cleaned, tested, and prepared for the indicated gas service and constructed in accordance with requirements of the latest edition of NFPA 99 and CGA.
3. The cylinder banks are arranged in a staggered configuration and provide an uninterrupted supply of gas for the specific gas application.
4. Keep all manifold parts, tools, and work surfaces free of oil, grease, and dirt. Do not use chemicals, lubricants or sealants unless approved by the manufacturer.

B. Mechanical contractor shall coordinate all required plumbing rough-in locations with casework manufacturer and all other trades.

3.6 PIPING SPECIALTIES

A. Dielectric Connections:

1. Install dielectric connections when piping of dissimilar metals piping and tubing are joined.
2. Dielectric Connections for NPS 2 and Smaller: Use stainless steel threaded nipples.
3. Dielectric Connections for NPS 2-1/2 and Larger: Use dielectric flange kits.

B. Trap Primers:

1. Toilet Rooms: In toilet rooms provide a trap primer line (TPL) from the water closet flush valve to the floor drain outlet pipe below the floor. Connections to the drain body with-in the concrete floor slab is not permitted.

2. Non Toilet Room Areas: In non-toilet room areas where a floor drain is required install an electronic trap primer system as close to the location of the floor drain as site conditions allow. The (TPL) must gravity drain to the floor drain outlet pipe connection. Maximum distance from the floor drain to the trap primer system must not exceed twenty (20) feet. Connections to the drain body with-in the concrete floor slab is not permitted. Mount enclosure in accessible locations with-in the project area or the mechanical equipment rooms. See drawings for locations. Adjust system for proper flow.

C. Cleanouts (CO):

1. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - a. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - b. Locate at each change in direction of piping greater than 45 degrees.
 - c. Locate at minimum intervals of fifty (50) feet for piping NPS 4 and smaller and one hundred (100) feet for larger piping.
 - d. Locate at base of each vertical sanitary and/or storm water stack.
2. Horizontal Piping above Ceilings: For cleanouts in concealed horizontal piping above a suspended ceiling provide one (1) of the following CO installations:
 - a. Where the CO location is not close a wall or partition on the floor above locate the cleanout at the floor slab above with a cover plate suitable for the floor finish.
 - b. Where the CO location is close a wall or partition on the floor above extend the piping into the wall or partition and locate the cleanout forty eight (48) inches above the finished floor with an access cover on the wall.
3. Horizontal Piping in Plumbing Chases: For cleanouts in concealed horizontal piping in plumbing chases serving wall mounted fixtures locate the cleanout forty eight (48) inches above the finished floor with an access cover on the wall.

3.7 INSTALLATION – PIPE SLEEVES

- A. Fire Rated Walls: Where new and/or existing plumbing piping passes through rated walls provide pipe sleeves with required fire sealant materials to maintain the rating of the wall assembly.
 1. Use standard weight steel pipe or service weight cast iron pipe for pipe sleeves. Where sleeves are installed in floors and load bearing walls, use only standard weight steel pipe for pipe sleeves.

2. Provide a minimum of one half (1/2) inch annular space clearance around the entire circumference of the pipe and/or insulation on cold piping passing through the sleeve and between the pipe sleeve and the surface of the core drilled hole.
3. Center pipe passing through sleeve.
4. Except for cold piping, do not continue insulation through sleeve.
5. The entire annular spaces must be sealed with fire and waterproof sealant Seal ends of pipe insulation and butt insulation ends up to fire stopping sealant in sleeve.
6. Sleeves in walls must be installed flush with both finished wall surfaces.
7. In finished areas provide an escutcheon plate around the bare pipe or insulated pipe passing through the assemblies to conceal the sleeve and sealant.

<Engineer Note: Where openings in walls for pipe sleeves are large enough to require additional structural supports such as lintels the A/E team shall coordinate the additional wall supports with structural engineer>

- B. Fire Rated Floors: Where new and/or existing plumbing piping passes through rated walls provide pipe sleeves with required fire sealant materials to maintain the rating of the wall assembly.
1. Use standard weight steel pipe or service weight cast iron pipe for pipe sleeves.
 2. Provide a minimum of one half (1/2) inch annular space clearance around the entire circumference of the pipe and/or insulation on cold piping passing through the sleeve and between the pipe sleeve and the surface of the core drilled hole.
 3. Center pipe passing through sleeve.
 4. Except for cold piping, do not continue insulation through sleeve.
 5. The entire annular spaces must be sealed with fire and waterproof sealant.
 6. Seal ends of pipe insulation and butt insulation ends up to waterproof sealant in sleeve.
 7. Sleeves must be installed with top of sleeve one (1) inch above the finished floor surface. The bottom of the sleeve must be flush with the finished surface of the underside of the floor assembly.
 8. In finished areas provide an escutcheon plate around the bare pipe or insulated pipe passing through the assemblies to conceal the sleeve and sealant. If a riser clamp is in place, omit the escutcheon.
- C. Sealant Requirements: Comply with requirements for sealants specified in Part 2.
- D. Fire-Barrier Penetrations: Comply with requirements for firestopping specified in Part 2.
- E. Non-Fire-Rated Soundproof Partition Penetrations: Where pipes pass through interior partitions with sound proofing provide a pipe sleeve. Seal the annular spaces between construction openings, the sleeve, the pipe and/or pipe insulation with soundproof insulation material equal to the width of the opening. The soundproof insulation shall match the insulation in the partition. <Delete if not required>

3.8 INSTALLATION – VALVES

- A. Valves shall be placed in such manner as to be easily accessible for smooth and easy hand wheel operation and packing maintenance.
- B. Install valves in piping systems were shown on drawings, diagrams and details and were indicated below:
 - 1. To Isolate:
 - a. Toilet rooms.
 - b. Laboratory sinks
 - c. Laboratory gas outlets.
 - d. Motorized flow control valves.
 - e. Equipment.
 - f. Pipe risers.
 - g. Branch piping.
 - 2. To Drain:
 - a. Low points in piping systems.
 - b. Pipe risers.
 - c. Equipment.
 - d. Trapped sections in the piping system.
 - 3. To Balance:
 - a. Flow in HWR piping systems.
- C. Where piping or equipment may be subsequently removed, provide valves with bodies, having integral flanges or full lugs drilled and tapped to hold valve in place so that downstream piping or equipment can be disconnected and replaced with blank-off plate while valve is still in service.
- D. Shut off valves serving equipment and/or control valves shall be installed full size at the equipment connection.
- E. Where there is no interference, shut-off valves shall be installed with hand wheel located up on the horizontal runs of pipe to prevent accumulation of foreign matter in working parts of valves.
- F. On valves, strainers, etc., installed in copper piping, provide a union on the discharge side of each valve, and threaded adapters where copper piping connects to valves, strainers, etc.
- G. Where valves are installed in piping systems for pressure gauges, P/T plugs, DP Switches etc, for each device provide a three quarter (3/4) inch tap in piping systems one (1) inch and larger and provide a one half (1/2) inch tap in piping systems less than one (1) inch.

- H. Install drain valves at low points of risers and at trapped/low points in mains, branch lines, and everywhere else required to permit drainage of the entire piping system.
- I. Where threaded ball valves are installed in brazed copper piping systems braze each threaded adapter on to the piping. After each adapter has cooled to the touch install the threaded ball valve. Do not connect the threaded adapter to the valve and then braze the adapter and valve to the piping as this will result in damage to the valve seals. If any valve, in the brazed piping systems are damaged due to faulty installation the damaged valves shall be replaced by the contractor at no cost to the University.
- J. Where butterfly valves are installed in copper piping systems provide companion flanges and dielectric gasket kits for each flange. When valves and/or fittings are installed in piping where electrolysis may occur provide dielectric flange kits at each connection. In heating hot water systems where dielectric connections are required, provide connections rated for an operating temperature of at least 200°F minimum.

3.9 INSTALLATION – COMMERCIAL ELECTRIC HOT WATER HEATERS <Delete if not Required>

- A. Hot water heater installation shall comply with the requirements of the latest edition of the Plumbing Code adapted by the State of Maryland.
- B. The water heaters shall be installed level and plumb and securely anchored.
- C. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
- D. Water heaters shall be installed on concrete housekeeping pads unless elevated above the floor. Comply with requirements for housekeeping pads [specified in Architectural Specification Sections "Cast in Place Concrete." and "Miscellaneous Cast in Place Concrete."] [in this Division and detailed on the drawings.] <Edit for Project>
- E. The water heaters shall be installed and connected in accordance with manufacturer's written instructions with manufacturer's recommended clearances.
- F. All pressure and temperature relief valves discharge shall be piped to nearby floor drains with air gap.
- G. Dielectric unions shall be provided if there are dissimilar metals between the water heater connections and the attached piping.
- H. Shutoff valves and unions shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.

- I. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank in accordance with manufacturer's recommendations. The sensing element shall extend into the tank. The relief valve outlet drain piping shall discharge by air gap into a floor drain.
- J. Where hot water is recirculated, see details and diagrams on drawings for the pump and piping requirements.

3.10 BALANCING VALVES – DOMESTIC HOT WATER RECIRCULATING SYSTEMS

- A. Where balancing valves are installed in multiple branch recirculating pipes provide a check valve and a shut off valve in the branch piping at the connection to the main return riser.

3.11 INSTALLATION – HANGERS AND SUPPORTS

- A. Piping Systems: Hangers and supports shall be provided for all piping systems, as recommended by the hanger manufacturers for the existing structural elements. Additional requirements are as follows:
 - 1. On piping systems requiring insulation, hangers and supports shall be installed external to the insulation material, and sheet metal saddles shall be provided.
 - 2. Hangers and supports shall be provided at all changes of direction and elevations on piping system.
 - 3. Spacing shall be as recommended by manufacturer, for each pipe size and material type.

3.12 INSTALLATION – PIPE INSULATION

- A. Fiberglass Pipe Insulation:
 - 1. All insulation shall be installed by a qualified insulation contractor. Insulation installed on cold surfaces shall have a vapor barrier and exposed ends shall be sealed. All insulation shall be installed and all seams, sealed, with Benjamin Foster sealant, according to manufacturer's recommendations.
 - 2. Bond insulation to pipe with lagging adhesive.
 - 3. Seal exposed ends with lagging adhesive.
 - 4. Seal seams and joints with vapor barrier compound.
 - 5. Where existing pipe insulation is disturbed for demolition work, and piping is capped, repair and seal damaged insulation.

6. Where existing pipe insulation is disturbed for demolition work, and new piping is connected at that location, butt new insulation up to the existing insulation and seal the joints as specified herein.
7. On new piping systems requiring insulation all pipe insulation shall be continuous through point of support. Provide sheet metal saddles between insulation and pipe hangers.
8. Where new piping connects to existing piping the new insulation shall match the thickness of the existing insulation.

3.13 INSTALLATION – PIPE LABELS

- A. General: Provide pipe labels with directional arrows every twenty five (25) feet on straight runs of horizontal and vertical pipes exposed in equipment rooms, utility shafts and above ceilings. In addition to the referenced spacing above comply with the following:
 1. Where pipes pass through floors, walls and partitions provide pipe labels on each side of the penetration.
- B. Exposed Piping: Install pipe labels in accessible locations on the piping systems so they are visible from the floor. Do not install pipe labels on sections of pipe that are not in a person's sight line.
- C. Concealed Piping: Install pipe labels in accessible locations on the piping systems so they are visible from the point of access through the ceiling tile or ceiling access door.
- D. Directional Arrows: Install directional arrows to indicate the correct flow direction.
- E. All pipe labels and flow arrows that are found to be incorrectly installed shall be replaced and corrected at no additional cost to the project.

3.14 CONCRETE HOUSEKEEPING PADS <Delete if not Required>

- A. General: Construct concrete housekeeping pads to support mechanical equipment were indicated and as detailed on the drawings and as specified herein. Engage the services of the Structural or General Contractor, and pay for them, to provide the concrete housekeeping pads. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations.
- B. Housekeeping Pads: Set all floor-mounted equipment on four (4) inch high concrete housekeeping pads, unless otherwise shown or specified.

1. Housekeeping Pads: Pads shall be a minimum of four (4) inches wider and longer than vibration isolation base or structural base of equipment being set on pad.

3.15 FLUSHING AND DISINFECTING POTABLE WATER SYSTEM PROCEDURE

<Coordinate with UMB and Edit for Project>

- A. General Requirement: The contractor shall secure the services of the water treatment company that is under service contract to UMB, to clean, flush and add chemical treatment to new piping systems that are required to be connected to existing piping systems serving the building or campus. The cost for labor and material for this work must be included in the contractors bid price. The contractor shall be responsible for the scope of work for the UMB water treatment company.
- B. Piping Systems: Where new potable water piping (cold water, hot water, hot water return) and/or laboratory water piping laboratory (lab cold, hot, hot water return) distribution piping are connected to the existing potable and/or lab water system the new piping and the sections of the existing piping downstream from the new pipe connections and the piping to the new plumbing fixtures and outlets shall be flushed until the water runs clear and free of debris or particles and disinfected. Faucet aerators or screens shall be removed during the flushing operation.
- C. Flushing: Isolate the existing and new water piping in the project area from the rest of the floor or building. Flush the isolated piping system including the faucets, with clean cold water for at least twenty (20) minutes or until the water is clear of any particles or debris.
- D. Disinfecting: Comply with the following:
 1. All water outlets shall be posted to warn against use during disinfecting operations.
 2. Disinfecting shall be performed by persons experienced in such work.
 3. The water supply to the piping system or parts thereof being disinfected shall be valved-off from the normal water source to prevent the introduction of disinfecting agents into a public water supply or portions of a system that are not being disinfected. The plumbing contractor shall provide plumbing connections and power for pumping chlorine into the system.
 4. The piping shall be disinfected with a water-chlorine solution. During the injection of the disinfecting agent into the piping, each outlet shall be fully opened several times until a concentration of not less than fifty (50) parts per million chlorine is present at every outlet. The solution shall be allowed to stand in the piping for at least twenty four (24) hours.
 5. At the end of the required retention time, the residual level of chlorine at every outlet shall be not less than five (5) parts per million. If the residual is less than five (5) parts per million, the disinfecting procedure shall be repeated until the required minimum chlorine residual is obtained at every outlet.
 6. After the required residual chlorine level is obtained at every outlet, the system shall be flushed to remove the disinfecting agent. Flushing shall continue until the

chlorine level at every outlet is reduced to the chlorine level of the water serving areas outside on the project area.

7. Any faucet aerators or screens that were removed shall be replaced.

E. Certification: A certification of performance and laboratory test report showing the absence of coliform organisms shall be submitted to the UMB upon satisfactory completion of the disinfecting operations.

3.16 CLEAN – UP

A. Excessive debris and dirt, such as occurs from cutting through masonry or plaster walls shall be cleaned up from the equipment and removed immediately after the work of cutting through the walls.

B. Debris shall be removed from UMB property.

C. Ceiling panels shall be replaced as soon as work is finished in the area and shall be kept free of dirty fingerprints. Where work is being done in corridors used by patients and visitors, ceiling panels shall be replaced at the close of the day's work even if work is at the particular location is incomplete.

D. All areas shall be left broom-clean at the end of the work period.

E. Remove all mechanical clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

3.17 FUNCTIONAL TESTING OF PLUMBING SYSTEMS

A. Testing Preparation:

1. Certify in writing to the UMB testing agent that new plumbing systems, subsystems, and equipment have been installed, and are operating according to the Contract Documents.

2. Certify in writing to the UMB testing agent that new plumbing systems have been leak tested according to the Contract Documents.

3. Certify in writing to the UMB testing agent that new plumbing systems have been flushed and disinfected according to the Contract Documents.

B. New Plumbing Systems, Subsystems, and Equipment Testing Procedures:

1. Procedures: Where applicable follow manufacturer's written procedures. If no procedures are prescribed by the manufacturer, proceed as indicated.

2. Plumbing Piping Distribution Systems: Includes domestic water piping, laboratory water piping, air, natural gas, laboratory gas and vacuum piping installed in the project area.
 - a. Verify that all new valves and accessories have been installed correctly, are accessible and operate as intended.
 - b. Verify that specified tests of piping are complete.
 - c. Verify all new plumbing fixtures and accessories have been installed correctly and are operating as intended.
 - d. Verify all new fume hoods and/or biosafety cabinets and accessories have been installed correctly and are operating as intended.
 - e. Verify all new safety equipment and accessories have been installed correctly and are operating as intended.

3.18 WET TAP PROCESS <Delete if not Required>

- A. General: When existing plumbing systems cannot be shut off and drained for new connections the contractor shall coordinate with UMB to wet tap the system requiring new connections as follows:
 1. Piping Systems up to Four (4) Inches: Use an Apollo 77FLF-140 full port ball valve only as specified. Size the valve to match the new pipe connection.
 2. Piping Systems Six (6) Inches and Larger: Provide an appropriately sized gate valve for the wet tap process. Provide a specified butterfly valve downstream of the gate valve for shut off duty. Size the butterfly valve to match the new pipe connection. Lock the gate valve in the open position.

3.19 COMPLETED HYDROSTATIC/LEAK TEST FORMS

- A. Upon completion of each hydrostatic/test, the contractor shall upload the signed leak test forms to the Project File, in ebuilder, in Folder 11.06 Test Reports.

3.20 UMB STANDARD HYDROSTATIC/LEAK TEST SUMMARY FORMS

- A. General: Contractors shall use the UMB Standard Form for Recording the Hydrostatic/Leak Test Results for all Pipe Systems Tested on this Project.
 1. Pipe System Sample Form: See the following page for a sample of the UMB Standard Pipe System Hydrostatic/Leak Test Summary Form.
 2. Availability: The standard test summary form is available on the UMB Web Site at:
<https://www.umaryland.edu/designandconstruction/resources/contractors/>

3. Field Testing: For field testing download and copy the forms from the UMB web site. <Do not use attached “Sample Forms” for testing>

UMB STANDARD PIPE SYSTEM HYDROSTATIC/LEAK TEST SUMMARY FORM

TEST DATA:

Date: _____ Project Number: _____

Location: _____

Pipe System Tested (Service): _____

Location and Description: _____

Pipe Materials: _____

Operating Pressure: _____

Specified Test Pressure: _____

Actual Test Pressure: _____

Pressure Test Type: _____

Test Start Time: _____ Recorded Test Pressure: _____

Test Completion Time: _____ Recorded Test Pressure: _____

Test Duration: _____ Pressure Drop or Rise: _____

Test Result (Pass/Fail): _____

SIGNATURES:

Construction Manager: _____

Construction Manager Representative: _____

Mechanical Contractor: _____

Mechanical Contractor Forman: _____

UMB Division: _____

UMB Witness: _____

Remarks: _____

END OF DIVISION 220000