

**Part 1      General**

**1.1          RELATED SECTIONS**

- .1    Section 22 11 18 - Domestic Water Piping Copper.
- .2    Section 22 13 18 - Acid Drainage Waste and Vent Piping
- .3    Section 22 15 00 - General Service Compressed Air Systems

**1.2          SUBMITTALS**

- .1    Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Shop drawings: in accordance with Section 23 05 00 - Mechanical General Requirements.
- .3    Closeout submittals: in accordance with Section 23 05 00 - Mechanical General Requirements.
- .4    As-built drawings: in accordance with Section 23 05 00 - Mechanical General Requirements.

**1.3          QUALITY ASSURANCE**

- .1    Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2    Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 70 50 - Health and Safety.

**1.4          WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials in accordance with Section 01 35 50 - Waste Management and Disposal.
- .2    Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .3    Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.
- .4    Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.
- .5    Remove from site and dispose of packaging materials at appropriate recycling facilities.

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- .6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 PAINTING REPAIRS AND RESTORATION**

- .1 To Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

**3.2 CLEANING**

- .1 Clean interior and exterior of all systems including strainers.

**3.3 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
  - .1 Pressure test reports.

**3.4 PROTECTION**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**3.5 SCOPE OF WORK**

- .1 Modify, relocate and extend existing plumbing service piping (domestic water, compressed air, natural gas, vacuum air, acid waste and vent) for new fume hood installation. Remove existing plumbing service piping and outlets on counter top in lab 4161 as noted on plans. All new pipes, valves and fittings shall be at least the same quality or better to the existing piping system.

**END OF SECTION**

**Part 1      General**

**1.1          SECTION INCLUDES**

- .1    Materials and installation for copper domestic water service used in the following:
  - .1    Copper cold water supply to fume hoods.

**1.2          RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 35 50 - Waste Management and Disposal.
- .3    Section 01 70 50 - Health and Safety.
- .4    Section 01 78 00 - Closeout Submittals.
- .5    Section 01 81 00 - Commissioning General Requirements
- .6    Section 23 05 00 - Mechanical General Requirements.

**1.3          REFERENCES**

- .1    American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
  - .1    ANSI/ASME B16.15-[11], Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2    ANSI/ASME B16.18-[12], Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3    ANSI/ASME B16.22-[12], Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4    ANSI/ASME B16.24-[06], Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2    American Society for Testing and Materials International, (ASTM).
  - .1    ASTM A307-[12], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2    ASTM B88M-[05(2011)], Standard Specification for Seamless Copper Water Tube (Metric).
  - .3    ASTM F492-[95], Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.
- .3    American Water Works Association (AWWA).
  - .1    AWWA C111-[12], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4    Canadian Standards Association (CSA International).

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- .1 CSA B242-[R2011], Groove and Shoulder Type Mechanical Pipe Couplings.
  - .5 Department of Justice Canada (Jus).
    - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
  - .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
    - .1 Material Safety Data Sheets (MSDS).
  - .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
    - .1 MSS-SP-67-[02], Butterfly Valves.
    - .2 MSS-SP-70-[98], Cast Iron Gate Valves, Flanged and Threaded Ends.
    - .3 MSS-SP-71-[05], Cast Iron Swing Check Valves, Flanged and Threaded Ends.
    - .4 MSS-SP-80-[08], Bronze Gate, Globe, Angle and Check Valves.
  - .8 National Research Council (NRC)/Institute for Research in Construction.
    - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - [2010].
  - .9 Transport Canada (TC).
    - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).
  - 1.4 SUBMITTALS**
    - .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - 1.5 HEALTH AND SAFETY**
    - .1 Do construction occupational health and safety in accordance with Section 01 70 50 - Health and Safety.
  - 1.6 WASTE MANAGEMENT AND DISPOSAL**
    - .1 Separate waste and recycling materials in accordance with Section 01 35 50 - Waste Management And Disposal.
    - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
    - .3 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.
    - .4 Place materials defined as hazardous or toxic in designated containers.

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- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
  - .6 Fold up metal banding, flatten and place in designated area for recycling.

## **Part 2 Products**

### **2.1 PIPING**

- .1 Domestic cold systems within building.
  - .1 Above ground: copper tube, hard drawn, type K: to ASTM B88M.

### **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

### **2.3 JOINTS**

- .1 Rubber gaskets, latex-free 1.6mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

### **2.4 BALL VALVES**

- .1 NPS 2 and under, screwed:
  - .1 Class 150.
  - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.
- .2 NPS 2 and under, soldered:
  - .1 To ANSI/ASME B16.18, Class 150.

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- .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install in accordance with NPC, British Columbia Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Modify and extend existing water piping for new fume hood installation.
- .7 Insulate all new domestic water pipes to match with existing.

#### **3.2 VALVES**

- .1 Isolate equipment, fixtures and branches with ball valves.

#### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of Section 23 05 00 - Mechanical General Requirements.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

#### **3.4 PRE-START-UP INSPECTIONS**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

#### **3.5 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and the Departmental Representative.

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- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval.

### **3.6 START-UP**

- .1 Timing: Start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

### **3.7 PERFORMANCE VERIFICATION**

- .1 Timing:
  - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .3 Verify compliance with safety and health requirements.
  - .4 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
  - .5 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
  - .1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

**END OF SECTION**

**Part 1      General**

**1.1          REFERENCES**

- .1    ASTM International Inc.
  - .1    ASTM D3222- 10, Standard Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
  - .2    ASTM F1673 - 10, Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems.
- .2    Underwriters Laboratories of Canada (ULC)
  - .1    ULC/ORD-C996.1-2000 Drainage Systems, Corrosive, Polyvinylidene Fluoride (PVDF).

**1.2          ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3          DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle in accordance with Section 01 61 00 - Basic Product Requirements.
- .2    Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3    Store at temperatures and conditions recommended by manufacturer.

**Part 2      Products**

**2.1          PIPING AND FITTINGS**

- .1    For above ground acid waste piping to all drains and vent pipes:
  - .1    ULC/ORD-C996.1-2000 (PVDF).



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**Part 3      Execution**

**3.1          APPLICATION**

- .1    Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.2          INSTALLATION**

- .1    Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.
- .2    Modify and extend existing acid waste drain and vent piping for new fume hood installation in lab 4161. Refer to plans. Cap the cup sink drain for the fume hood in room 2244.
- .3    Provide adaptors and transitions to connect new PVDF pipes to existing glass and Pegas polypropylene pipes.

**3.3          TESTING**

- .1    Hydraulically test to verify grades and freedom from obstructions.

**3.4          PERFORMANCE VERIFICATION**

- .1    Cleanouts:
  - .1    Ensure accessible and that access doors are correctly located.
  - .2    Open, cover with linseed oil and re-seal.
  - .3    Verify cleanout rods can probe as far as the next cleanout, at least.
- .2    Test to ensure traps are fully and permanently primed.
- .3    Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4    Affix applicable label (acid waste) c/w directional arrows every floor or 4.5 m (whichever is less).

**3.5          CLEANING**

- .1    Remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1      General**

**1.1          SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for piping, fittings, equipment used in compressed air systems.
- .2 Related Sections:
  - .1 Section 01 33 00 - Submittal Procedures.
  - .2 Section 01 45 00 - Quality Control.
  - .3 Section 01 35 50 - Waste Management and Disposal.
  - .4 Section 01 78 00 - Closeout Submittals.
  - .5 Section 23 05 00 - Mechanical General Requirements.

**1.2          REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.
    - .1 BPVC-VIII B - 2013, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
    - .2 BPVC-VIII-2 B - 2013, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
    - .3 BPVC-VIII-3 B - 2013, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.
  - .2 ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  - .3 ASME B16.11-11, Forged Fittings, Socket-Welding and Threaded.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A181/A181M-12, Standard Specification for Carbon Steel Forgings for General Purpose Piping.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

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**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
- .3 Shop Drawings:
  - .1 Submit shop drawings to indicate project layout including layout, dimensions and extent of piping system.
    - .1 Vertical and horizontal piping locations and elevations and connections details.
    - .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
    - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
    - .4 Instructions: submit manufacturer's installation instructions.
    - .5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 70 50 - Health and Safety.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 50 - Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

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- .4 Separate for reuse and recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan (WMP).
  - .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA and Regional and Municipal regulations.
  - .6 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

## **Part 2 Products**

### **2.1 PIPING**

- .1 Piping shall match with existing material on site.
- .2 Piping: to ASTM-B88, Type L hard temper seamless copper tubing, factory degreased, capped ends.
- .3 Fittings and Joints:
  - .1 Fittings shall be wrought copper pressure, factory degreased with capped ends.
  - .2 Pipe joints shall be made utilizing a silver brazing alloy or similar high melting point (538°C [1,000°F] minimum) brazing metal conforming to AWS Classification BCuP-5.
  - .3 Valves and equipment shall be joined utilizing screwed joints. The male thread shall be tinned with soft solder.
  - .4 Litharge, glycerin or an approved oxygen luting or sealing compound is acceptable. Flux shall not be used on copper to copper connections. Flux conforming to AWS brazing flux No. 3A is permitted where silver brazing dissimilar metals in which case particular care shall be exercised to ensure that no flux penetrates to the inside of the pipe and the completed exterior of the joint is washed with hot water to remove all residual flux from the fitting and pipe joint.
- .4 Dissimilar metal junctions: use dielectric unions.

### **2.2 BALL VALVES**

- .1 Three piece design or top entry for ease of in-line maintenance.
  - .1 Suitable for compressed air application.
  - .2 To withstand 1034 kPa maximum pressure.

### **2.3 COUPLERS/CONNECTORS**

- .1 Industrial interchange series, full-bore.

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- .2 Maximum inlet pressure: 1700 kPa.
  - .3 Valve seat: moulded nylon.
  - .4 Body: zinc plated steel.
  - .5 Threads: NPT.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### **3.2 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION**

- .1 Install shut-off valves at outlets, major branch lines and in locations as indicated.
- .2 Install quick-coupler chucks and pressure gauges on drop pipes.
- .3 Install unions to permit removal or replacement of equipment.
- .4 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.
- .5 Grade piping at 1% slope minimum.
- .6 Make branch connections from top of main.
- .7 Weld steel piping in accordance to ASME code and requirements of authority having jurisdiction.
- .8 Weld concealed and inaccessible piping regardless of size.
- .9 Modify and extend existing compressed air piping for new fume hood installation in lab 4161.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Testing: pressure test in accordance with requirements of Section 23 05 00 - Mechanical General Requirements, for 4h minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

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- .2 Obtain reports within 3 days of review and submit immediately to Departmental Representative.

**3.4 CLEANING**

- .1 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.
- .2 Check entire installation is approved by authority having jurisdiction.
- .3 Perform cleaning operations in accordance with manufacturer's recommendations.
- .4 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**