1. This information provides guidelines for basic mechanical installation methods and materials. General mechanical requirements, detailed mechanical requirements, site drainage, and temporary facilities and controls are covered in other parts of these standards or are available from the FM project representative. Reference “DIVISION 20 General Mechanical” standard for overall mechanical system design guidelines.

2. FM project representative, FM, Public Safety Office, and Environmental Health and Safety Office shall approve selection of materials, means, and methods. Unless otherwise approved, the design intent requires means and methods that provide minimal disruption to adjacent building activities and operations.

3. When working in or adjacent to occupied buildings, require means and methods that protect occupants from exposure to noise, dust, traffic, and other hazards.

4. FM project representative shall inform FM and other campus departments or groups affected by the work.

5. Environmental safety and health:
   a. During preliminary design, coordinate to define scope of asbestos or other hazardous material abatement and/or notification requirements per current regulations.
   b. Maintain or improve existing levels of indoor and outdoor air quality for workers, occupants, and general public during the work.
   c. Require curbs around all vertical openings in mechanical room floors 4’0” or more in depth.
   d. Require openings large enough to fall through between piping and ductwork within a vertical shaft to be protected by a railing. Railing shall not obstruct maintenance access.

6. General:
   a. All distribution pipe and ductwork installations shall be concealed in walls, chases, utility spaces, or above ceilings.
   b. All components requiring periodic maintenance or observation shall be readily accessible and labeled.
   c. Permanently mark location of concealed or buried piping in building structure for future locating. Provide tracer wire above all buried non-metal piping.
   d. Piping and ductwork shall be installed at right angles or parallel to building walls. Avoid diagonal runs.
   e. Locate runs of mechanical services grouped and parallel to each other with adequate space to allow maintenance and servicing.
   f. Provide a UL listed labeled access panel at each valve or damper concealed above a hard ceiling or behind a wall for maintenance of each system.
   g. All threaded connections shall be National Pipe Thread (NPT) standard.
   h. Prohibit “T-drill” connections.
   i. Require unions or flanged connections at all pieces of equipment, valves, and controls to allow for ease of removal.
   j. Require dielectric connections between copper and galvanized steel piping materials. Avoid dielectric connections between copper and black steel piping materials in heating water systems.
   k. Pipe sleeves in the floors for mechanical systems shall extend 2” (50 mm) above the floor.
   l. Provide isolation valves at each piece of equipment to allow for complete removal of the equipment from services without having to shut down or drain the entire system.
m. Require isolation valves for individual floors, wings, or other portions of a system to allow for future work without requiring complete building shutdowns.

n. Require drain valves with hose threaded connections in mains and at all low points to allow for draining isolated sections of piping.

o. Provide a bypass around the cold water main strainer in mechanical rooms. Prefer stainless steel grooved coupling strainer. Provide supply and building side pressure gauges around strainer.

p. Require readily accessible manual air vent at all high points in the system and at each piece of equipment.

q. Pipe all automatic air vents to floor drain.

7. Local instruments:
   a. Require all gauges in mechanical rooms to be visible, readable, and accessible from the floor.
   b. Require mercury-free dial temperature gauges/thermometers on intake and discharge piping at all heat exchange equipment where a water temperature change occurs.
   c. Require high quality liquid filled pressure gauges (manifold where possible) at all equipment where a change in pressure occurs, including coils, pumps, and pressure reducing stations. Install with needle valve or ball valve shutoffs. Avoid shutoff cocks. Require gauge snubbers on water and steam systems.
   d. Require ranges for temperature and pressure gauges to be appropriate for the system operating parameters.
   e. Require accessible T & P plugs in the supply and return piping at terminal water coils, finned radiators and convectors.
   f. For air system temperature and pressure sensor requirements, see “DIVISION 23 Mechanical Control Systems”.

8. Sound and vibration control and seismic supports:
   a. Design sound and vibration control for equipment in accordance with the latest edition of the applicable ASHRAE handbook.
   c. Isolate vibrating machinery from both the structure and from the connecting piping and ductwork.
   d. Isolator materials must be compatible with the chemical make-up of the material being transported.
   e. Flexible pipe connectors shall be Type 321 hose braided stainless steel for steel piping systems and bronze hose Type Unisource BF11 or approved for copper piping systems. Threaded connections for 2½” (63.5mm) diameter and smaller, flanged for larger for steel piping systems.

9. Pipe and fittings:
   a. Exterior buried drainage lines (storm and sanitary sewer):
      i. Comply with City of Bellingham Public Works Department Standards.
      ii. Cast iron soil pipe and fittings, hub and spigot per the American Society for Testing and Materials (ASTM) A74.
      iii. PVC sewer pipe and fittings per ASTM D2729. See “Site Drainage Section.”
   b. Above ground drain, waste and vent (DWV) piping within buildings (sanitary and roof drainage):
i. 2½" (63mm) diameter and smaller: Copper DWV drainage tube or seamless copper pipe with cast bronze threaded or copper solder joints drainage fittings. PVC plastic DWV piping with solvent cement is allowed for buildings less than two stories tall.

ii. 3" (76mm) diameter and larger: Cast iron soil pipe and fittings, service weight hubless with stainless steel couplings.

c. Buried or below slab drain, waste and vent piping within buildings:
   i. Cast iron soil pipe and fittings, hubless with stainless steel couplings.
   ii. Minimize piping below concrete slab. Provide clean outs as required for ready access to under slab piping.

d. Exterior buried water mains:
   i. Comply with City of Bellingham Public Works Department Standards.
   ii. Ductile iron pipe, American Water Works Association (AWWA) C151.

e. Domestic cold and hot water piping within buildings and utility tunnel:
   i. 2" (50mm) and smaller: ASTM B88 seamless, hard copper tube, Type L for aboveground piping, Type K for buried piping.
   ii. Wrought copper solder joint fittings and 95/5 or Plumbing Code approved lead free solder above ground. Flare fittings or silver solder below ground.
   iii. 2-1/2 to 4": ASTM B88 seamless, hard copper tube, Type L for aboveground piping, Type K for buried piping. Silver based solder (Sil-foss).
   iv. Require copper pipe nipples with threaded end connections at valves and unions.
   v. 5" (125mm) and larger: Seamless copper pipe with mechanically grooved fittings, or steel piping, Schedule 40, with seamless welded fittings.
   vi. Avoid PEX piping, exceptions require FM project manager approval.
   vii. Prohibit CPVC plastic piping.
   viii. Limited applications of press-fit fittings (ProPress) are acceptable only in domestic cold and hot water applications. Pre-approval of WWU FM is required.

f. Distilled and deionized water:
   i. Unpigmented polypropylene, high purity piping.

g. Heating water piping within buildings and utility tunnel:
   i. 2" (50mm) or smaller: ASTM B88 seamless, hard copper tube, Type L piping.
   ii. Wrought copper solder joint fittings and 95/5 solder.
   iii. 2-1/2 to 4": ASTM B88 seamless, hard copper tube, Type L for aboveground piping, Type K for buried piping. Silver based solder (Sil-foss).
   iv. 5" (125mm) and larger: Seamless copper pipe with mechanically grooved fittings, or steel piping, Schedule 40, with seamless welded fittings.

h. Refrigeration piping:
   i. Seamless copper tube for Air Conditioning and Refrigeration (ACR) Field Service, cleaned, dehydrated, and sealed.
   ii. Solder joint copper refrigerant fittings and adapters. Double flare cast copper alloy fittings are acceptable at equipment connections.
   iii. Provide silver brazing alloy solder (Sil-foss) and silver brazing alloy flux.
   iv. Installation procedures shall prevent moisture, dirt, or other foreign material from contaminating the piping system until final connections are made.
   v. All refrigeration piping shall be pressure tested and witnessed by the engineer and the Facilities Management project representative prior to insulating.

i. Steam and condensate piping within buildings and utility tunnels:
   i. 2" (50mm) diameter and smaller: ASTM A53, seamless, black steel pipe with threaded end connections.
   ii. 2½" (63.5mm) diameter and larger: ASTM A53, seamless, black steel pipe with welded end connections.
   iii. Steam and condensate piping with threaded end connections: Schedule 80 pipe.
iv. Steam piping with welded end connections: Schedule 40 pipe.
v. Condensate piping with welded end connections: Schedule 80 pipe.
vi. Threaded fittings: ASME B16.3 malleable iron fittings.
viii. Fittings shall be the same material and weight as the piping in which fittings are installed.

j. Compressed air piping within buildings and utility tunnel:
i. ASTM B88 seamless, hard copper tube, Type L piping. Wrought copper solder joint fittings and 95/5 solder.
ii. The main compressed air distribution system in the utility tunnel is steel. Provide dielectric fittings at point of connection.

k. Vacuum piping: ASTM B88 seamless, hard copper tube, Type L piping. Wrought copper solder joint fittings and 95/5 solder.

l. Exterior buried natural gas utility lines:
i. Provide HDPE PE 3408 up to 60 psig MAOP (PN20) meeting ASTM 2513-95b SDR 11 requirements.
ii. Comply with “Western Washington University Operations and Maintenance Plan” except contractor to provide materials.
iii. Provide locate wire for entire length of plastic piping.

m. Natural gas piping within buildings:
i. 2½” (63.5mm) diameter and less: ASTM A53 Gr B, seamless, schedule 40, black steel pipe with 150# (PN20) with ASME B16.3 malleable iron threaded fittings.
ii. 3” (76mm) diameter and larger: ASTM A53, Schedule 40, 150lb. steel pipe with welded fittings.
iii. Piping, valves, and anodeless risers shall comply with 49 CFR Part 192 and the “Western Washington University Operations and Maintenance Plan.”

10. Valves
a. Isolation valves:
i. 3” (76mm) and smaller: Prefer Apollo brand bronze or steel ball valves with appropriate trim.
ii. 4” (100mm) and larger: Prefer American Valve iron body flanged ball valve or butterfly valve with appropriate trim.
iii. Gate valves have proven to be unreliable for positive shutoff.
b. Provide full port ball valve with two position lever handle with positive shutoff.
c. End connections: Up to 3” (76mm) shall be threaded; greater than 3” (76mm) shall be flanged.
d. Require adequate unions and flanges at the valve for removal and repair, or provide a design which permits inspection and repair of seats and seals without removing valve body from line.
e. Provide label on all valves pertaining to area serviced along with label schedule in mechanical room.

End