N.B.: Changes or additions to this update of the Mechanical Guidelines are indicated with a

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<th>C</th>
<th>NC</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Requirements</td>
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<td></td>
</tr>
<tr>
<td>Life Cycle Guidelines, incl. life cycle costs for equipment</td>
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<table>
<thead>
<tr>
<th>D20 Plumbing</th>
<th>C</th>
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<td>D2010 Plumbing Fixtures</td>
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<td>D2050 Other Plumbing Systems</td>
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<table>
<thead>
<tr>
<th>D30 HVAC</th>
<th>C</th>
<th>NC</th>
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<tbody>
<tr>
<td>General Requirements</td>
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<td>D3010 Energy Supply</td>
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<td></td>
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<td>D3030 Cooling Generating Systems</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>D3040 Distribution Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3050 Terminal &amp; Packaging Unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3060 Control &amp; Instrumentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3070 Systems Testing &amp; Balancing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3090 Other HVAC Systems &amp; Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(C – Compliant; NC – Non-Compliant; NA – Not Applicable)

Net Increase in Building Mechanical Loads: BTU/hr = ______ CFM = _____ GPM = _____

The Engineer has verified the existing building systems are adequate for additional capacity noted above.

___________________________________________________________
Consultant                                          Consultant                               Date

___________________________________________________________
Mechanical Planning Manager         Mech. Plan. Signature                               Date

**Note:** If the Guidelines or part of cannot be attained or fulfilled (i.e. NC or NA) during the design process, the Consultant should provide reason(s) why such Guidelines are not met. Any modification or alterations to the design guidelines will need to be agreed/accepted by Facilities Management prior to inclusion in the design. See Design Guidelines Requests for Exemptions (Section 1.5).
General Requirements

Warranties

Identify clearly, in the project documents (i.e. in the equipment and shop manuals), any manufacturers’ or contractors’ warranties. Equipment warranties are to be initiated upon substantial completion of project.

Efficiency Nova Scotia Rebates

Energy efficiency must be considered and equipment specifications must align with those identified by Efficiency Nova Scotia as eligible for Business Energy Rebates. The rebates apply to the following categories:

- Compressed Air
- Hot Water Heating
- HVAC
- Motors & Variable Speed Drives
- Refrigeration Equipment


National Standards and Regulations

Any work on water supply for new construction or system upgrades shall meet the 1999 Fire Underwriters Survey (FUS) Water Supply for Public Fire Protection standard.

Placement of Equipment

1. Do not locate equipment in areas which are difficult to access or at risk of flooding.
2. Provision must be made for lifting and moving spare parts and chemicals into mechanical rooms. Electrical hoists or elevator access to be provided as deemed necessary.
3. Access to mechanical room shall be by stairs/elevators and through doors, rather than ladders and hatches.
4. The internal dimension of all access doors and panels must be a minimum of 12” x 12” with a fire rating of equal or greater value to the relevant wall or ceiling. Access doors shall be hinged with a positive locking mechanism.
5. All equipment shall be able to be individually isolated for maintenance when required.
6. Equipment shall be placed to be in accordance to the manufacturer’s recommended clearance requirements, clearances may be shared in design. If the recommended area is not available, the Placement of Equipment must be indicated at non-compliant on the Compliance Checklist.
7. Fresh air intake for buildings must be appropriately located so that no fumes or building exhaust gets re-entrained into the air system, the Engineer must comment on how this has been achieved.
8. Areas which have data centres must have a dedicated air conditioning system with N +1 capacity.
9. Mechanical room floors:
   - Provide adequate floor drains with floors sloped down to the drains.
   - Provide individual floor drains for equipment discharge.
10. Mechanical rooms must not be used as an air plenum in any circumstances.
11. Cooling towers shall be equipped with heavy galvanized steel platforms constructed in such a way as to allow easy access to serviceable components of cooling towers (e.g. motors, fans, etc.).

12. Equipment should not be placed closer than 6’0” from the edge of the roof.

13. Equipment should be located with consideration of snow accumulation and removal. As well as protected from snow removal operations.

14. Internal waterproof lighting shall be installed in all accessible air handling unit compartments.

15. Hinged access doors shall be installed with latching hold-open devices and door handles on both sides of door for equipment compartments. Access doors shall be designed to permit and facilitate coil removal space.

16. Equipment shall be located to allow for sufficient space for the removal of coils from air handling units. Such allotted coil removal space should be indicated on the drawings. Appropriate lifting facilities, such as eye bolts, I-beams and A-frames shall be provided for coils heavier than 200lbs.

17. Consultants specifying equipment to be placed on the roof must provide a detailed drawing of sleepers, penetrations, etc. It is the responsibility of the Consultant to ensure the detailed drawing is signed off by a qualified roofing consultant and ensure warranties are not voided by works carried out.

Life Cycle Guidelines

Dalhousie University is concerned with the long-term stewardship. The table below highlights the anticipated lifecycle of equipment to be adhered to. In the case of building extensions, the addition will be designed with a life expectancy equal to the expected life of the building being extended.

<table>
<thead>
<tr>
<th>Element</th>
<th>Years</th>
<th>Element</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping</td>
<td>50</td>
<td>Humidifier</td>
<td>20</td>
</tr>
<tr>
<td>Valve</td>
<td>20</td>
<td>Convector</td>
<td>25</td>
</tr>
<tr>
<td>Steam speciality</td>
<td>20</td>
<td>Unit Heater</td>
<td>20</td>
</tr>
<tr>
<td>Insulation</td>
<td>25</td>
<td>Unit Ventilator</td>
<td>20</td>
</tr>
<tr>
<td>Pump</td>
<td>20</td>
<td>HR Device</td>
<td>20</td>
</tr>
<tr>
<td>Fixture</td>
<td>20</td>
<td>Hood</td>
<td>20</td>
</tr>
<tr>
<td>Water Heater</td>
<td>20</td>
<td>Ductwork</td>
<td>50</td>
</tr>
<tr>
<td>Boiler</td>
<td>50</td>
<td>Coil</td>
<td>50</td>
</tr>
<tr>
<td>Burner</td>
<td>20</td>
<td>Fan</td>
<td>25</td>
</tr>
<tr>
<td>Furnace</td>
<td>20</td>
<td>Condensing Unit</td>
<td>20</td>
</tr>
<tr>
<td>Chiller</td>
<td>20</td>
<td>Filter</td>
<td>20</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>20</td>
<td>Compressor</td>
<td>20</td>
</tr>
<tr>
<td>Heat Exchanger</td>
<td>25</td>
<td>Air Device</td>
<td>25</td>
</tr>
<tr>
<td>Air Handling Unit</td>
<td>20</td>
<td>Control Device</td>
<td>20</td>
</tr>
<tr>
<td>Heat Pump</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# D20 – Plumbing

D2010 – Plumbing Fixtures

The manufacturers listed below are preferred, but not mandatory. Equal and approved equivalents maybe accepted.

<table>
<thead>
<tr>
<th>Fixture</th>
<th>Suggested Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water Backflow Preventers</td>
<td>Watts</td>
</tr>
<tr>
<td>Fixture Carriers (Toilets)</td>
<td>Zurn</td>
</tr>
<tr>
<td>Floor and Roof Drains</td>
<td>Zurn</td>
</tr>
<tr>
<td>Vanity Laboratory Basin</td>
<td>Aristilane OV1721R</td>
</tr>
<tr>
<td>Stainless Steel Sinks</td>
<td>Frankie, AMI</td>
</tr>
<tr>
<td>Valves for copper piping (incl. gate, globe, swing check and ball valves)</td>
<td>Crane, Newman Hattersley, Apollo</td>
</tr>
<tr>
<td>Custodial Sink</td>
<td></td>
</tr>
<tr>
<td>Washroom Sink (Residence)</td>
<td>Crane, American Standard</td>
</tr>
<tr>
<td>Washroom Sink (Non Res.)</td>
<td></td>
</tr>
<tr>
<td>Electronically activated flush valves for urinals (Not concealed type)</td>
<td>Zurn or Sloan</td>
</tr>
<tr>
<td>Dual-flush manual flush valve for toilets</td>
<td>Zurn or Sloan</td>
</tr>
<tr>
<td>Toilets</td>
<td>Kohl, American Standard, Crane</td>
</tr>
<tr>
<td>Urinals</td>
<td>Kohl, American Standard, Crane</td>
</tr>
<tr>
<td>Automatic motion sensor faucet</td>
<td>Delta, Sloan, Moen, or Chicago</td>
</tr>
<tr>
<td>Manual single lever faucet for vanity basin</td>
<td>Delta or Sloan</td>
</tr>
<tr>
<td>Pumps, cold water</td>
<td>Armstrong, Aurora, Bell &amp; Gossett (B&amp;G)</td>
</tr>
<tr>
<td>Water fountains</td>
<td>ELKAY</td>
</tr>
</tbody>
</table>
Water Closets

1. White vitreous china.
2. Water closets shall be fitted with 3L and 6L dual-flush manual flush-o-meters.
3. Water closets should be elongated style, with open-front plastic seat and no seat cover lid.
4. Water closets may be either floor mounted or wall mounted, if wall mounted, the mechanical chase shall be easily accessible for maintenance purposes.
5. Three pieces of the flushing equipment, the valve, flush and drain, must be compatible.

Urinals

1. White vitreous china.
2. Urinals shall be mounted with an exposed, low flow automatic flush-o-meter electrically supplied with low voltage from a transformer mounted in a concealed space.

Sinks

1. Washroom sinks:
   a. White vitreous china
   b. Lavatory faucets (non-residence) shall be automatic motion sensor, the sink shall not be fitted with plugs or chains. Taps should be of commercial grade.
   c. Lavatory faucets (in residences) shall be manual, single lever with plug and/or chain. Taps should be of commercial grade.
   d. Lavatory basin waste shall have grids and extra heavy quality traps.
   e. All sinks should have accessible offset waste pipes, with accessible taps.
   f. The provision of lavatory basins mounted in vanity units is preferred for 2 or more basins in all public washrooms.

2. Custodial sinks should be a minimum of one mop sink per building level in custodial closets and shall be floor mounted 24”x24” by 12” high (Terrazzo or similar). A stainless steel splash guard on the wall to a height of 48” should be provided.

Drinking Fountain & Coolers

1. Coordinate locations of water fountains during design process. Water fountains shall be wall mounted, stainless steel, barrier-free, filtered, cooled, and able to fill water bottles.
D2020 – Domestic Water Distribution

D2021- Pipes & Fittings

Pipes and pipe fittings are to be in accordance with the following table:

<table>
<thead>
<tr>
<th>Domestic Hot &amp; Cold Water</th>
<th>Pipe Material</th>
<th>Fittings</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic hot water, less than 2”</td>
<td>Copper Type L</td>
<td>Wrought Copper</td>
<td>Soldered Joint</td>
</tr>
<tr>
<td>Domestic hot water, 2” and above</td>
<td>Copper Type L</td>
<td>Wrought Copper</td>
<td>Siflos*</td>
</tr>
<tr>
<td>Domestic cold water, less than 2” above ground</td>
<td>Copper Type L</td>
<td>Wrought Copper</td>
<td>Soldered Joints</td>
</tr>
<tr>
<td>Domestic cold water, minimum 2” above ground</td>
<td>Copper Type L</td>
<td>Wrought Copper</td>
<td>Siflos*</td>
</tr>
<tr>
<td>Domestic cold water, buried up to 2”</td>
<td>Copper Type K</td>
<td>Soft Copper</td>
<td>Mechanical Joint</td>
</tr>
<tr>
<td>Domestic cold water, buried over 2”</td>
<td>Ductile Iron</td>
<td>Ductile Iron</td>
<td>Mechanical Joint</td>
</tr>
<tr>
<td>Trap Seal Primer Line</td>
<td>Copper ‘L’ Soft Tubing, coated.</td>
<td>n/a</td>
<td>Job Specific</td>
</tr>
</tbody>
</table>

D2023 - Domestic Water Supply Equipment

Domestic cold water booster pumps shall have the following characteristics:

a. Pumps to be of close coupled or split coupled vertical, or close coupled horizontal design, all bronze construction.

b. Duplex or triplex pumping systems are required.

c. Pumps shall function on emergency power, where available.

D2024 Valves, Hydrants, & Hose Bibbs

1. Hose bibs shall be provided on the outside of the buildings at convenient locations; coordinate locations with Dalhousie University.

2. Isolation valves shall be provided at each individual fixture and a master isolation valve for each washroom.

3. Use full port ball valves up to 2” and gate or globe valves for larger pipe sizes.

4. Accessible hose bibs are preferred in bigger washrooms – those with a minimum of two toilets (where applicable) two urinals, and two sinks.
D2030 – Sanitary Waste

D2031- Waste Pipe and Fittings

Pipes and pipe fittings are to be in accordance with the following table:

<table>
<thead>
<tr>
<th>Sanitary Sewage</th>
<th>Pipe Materials</th>
<th>Fittings</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitary – below 3” inside building</td>
<td>DWV Copper*</td>
<td>DWV Copper</td>
<td>Soldered</td>
</tr>
<tr>
<td>Sanitary over 3” inside building</td>
<td>Cast Iron*</td>
<td>Cast Iron</td>
<td>Mechanical Joint</td>
</tr>
<tr>
<td>Sanitary less than 3” buried</td>
<td>ABS</td>
<td>ABS</td>
<td>Glued</td>
</tr>
<tr>
<td>Sanitary – 3” and over buried</td>
<td>PVC/ABS</td>
<td>PVC</td>
<td>Mechanical Joint (hub and ring gasket)</td>
</tr>
<tr>
<td>Sanitary – Laboratory/ Chemical</td>
<td>Glass/Blueline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste Piping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*PVC or PVC XFR will be considered on a case by case basis with justification.

1. Running traps must have cleanouts at the crown of each side of the trap.

D2033 – Floor Drains

1. Floor drain to be provided in custodial room.

D3034 – Sanitary Waste Equipment

1. Ejector pumps shall be accessible and fully serviceable. Bell and Gossett preferred.

D2040 – Rainwater Drainage

D2041 – Rainwater Pipes & Fittings

1. Pipes and pipe fittings are to be in accordance with the following table:

<table>
<thead>
<tr>
<th>Rainwater Water</th>
<th>Pipe Materials</th>
<th>Fittings</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm – Rain Water Leader (RWL) – inside building</td>
<td>Cast Iron</td>
<td>Cast Iron</td>
<td>Mechanical Joint</td>
</tr>
<tr>
<td>Storm – less than 3” buried outside the building</td>
<td>ABS</td>
<td>ABS</td>
<td>Glued</td>
</tr>
</tbody>
</table>
2. Sump Pumps
   a. Sump pumps in general shall be self-priming surface mounted direct drive type, with the exception that fractional horsepower units may be of the submersible type.
   b. Column or pedestal pumps are not acceptable. All pumps must be submersible.
   c. Sump pumps shall be accessible and fully serviceable. Sizing depends upon the sump receiver - single pump or duplex models. Consult with the Facilities team.

D30 – HVAC

D3010 – Energy Supply

D3014 – Steam Supply System

1. The preferred steam PRV manufacturer is Fisher 92B, and the preferred steam trap manufacturer is Armstrong.

D3015 – Hot Water Supply System

1. Acceptable performance for hot water circulation must be that hot water reaches faucets within 10 seconds.
2. The temperature of hot water at faucets must not exceed 120°F, where electric hot water tanks are the source of heat a tempering valve should be installed at each floor. In all other systems, the temperature to which hot water is heated should be set at 120°F.
3. The preferred brands for hot and chilled water pumps are Armstrong, Aurora, and Bell & Gossett.

D3030 – Cooling Generation Systems

D3032 – Primary Cooling - Condensing Units

1. Air conditioning equipment shall not use once-through domestic water for cooling; fluid cooling will only be permitted when connected to a closed loop heat rejection system.
2. Split systems or closed loop 50/50 water/propylene glycol systems with heat reclaim or outside heat rejection are to be used.
3. In the event that domestic water cooling must be used, the justification will need to be approved by the Mechanical Planner.
4. Closed loop fluid systems shall use propylene glycol. Ethylene glycol shall not be used.

D3036 – Piping & Fitting

1. Piping for refrigerants should have no flared joints.
2. Isolation ball valves shall be provided on supply and return lines. Crane is the preferred manufacturer. Size depends upon the equipment served.

D3037/3025 – Primary Pumps

1. Provide N + 1 redundancy for pumps of hot water, chilled water and steam systems. In-line centrifugal pumps are preferred.
   Where pumps are 2HP or more, duplex pumps to be installed where feasible.

D3040 – Air Distribution Systems

D3042 - Ventilation & Exhaust Systems

1. Heat systems connecting exhaust and fresh air systems are preferred wherever possible.
2. Fan bearings shall have lubrication nipples external to the unit for ready access.
3. All air handling units shall be placed in a penthouse where practical. Alternatives must be agreed by the University. Weather or corrosive material exposed air handling units require enhanced exterior construction, either of stainless steel, aluminum, or coated.
4. Drain pans in built-up air handling units are to be constructed of 304 stainless steel, 16 gauge. Pans shall slope down to drain with a minimum ¼" per foot 3-way slope and have a lip. Drain trap height shall exceed maximum fan suction static pressure at dirty filter condition and base rails for the air handling unit must be high enough to allow proper piping of traps to the drain pan.
5. All external louvers shall be constructed of aluminum except in cases where stainless steel is required.
6. Bird screens must be stainless steel.
7. Secondary Air Filters shall be front loading self-supporting cartridge type.
8. Secondary filters shall be MERV13 with Class II rating by Underwriters Laboratories of Canada and be labelled as such.
9. American Air Filters- VariCel is the acceptable manufacturer and type for the secondary filters.
10. Each unit to be complete with side or face loaded pre-filters and appropriate access to accommodate maintenance.
11. All AHUs pre-filters should be pleated type.
12. All heat pump filters should be pleated type.
13. Filter frames shall be constructed from minimum 304 stainless steel.
14. Material to match casing complete with filter arrangements.
15. Provide access to filter through hinged door.
16. Provide blank off plates to ensure zero bypass around filters.
17. Each holding frame shall be equipped with suitable filter holding devices
18. Holding frame seats shall be gasketed. All joints shall be airtight
20. Fume hood ducting shall be stainless steel with welded joints from the fumehood to the exhaust fan, including dampers and headers.
21. Vortex fans must have maintenance and repair crane, for safe work. By-pass dampers as required for proper system operation.
22. All aluminum fin coils shall be constructed with corrosion protective coating such as Heresite (to be approved by Dalhousie Rep) and stainless steel frame rather than galvanized or unprotected mild steel frame. Direct expansion evaporator coil, chilled water cooling coil and heating coil shall be Heresite coated.
23. Moisture eliminators shall be made of stainless steel.
24. Humidifiers must not use direct boiler steam for humidification.
25. Variable speed drives, where applicable, should be used for exhaust fans.
26. Ensure that new make up air is available either through adjustments to an existing system or installation of a new system.
27. Exhaust fans shall be placed in mechanical spaces, not occupied or finished spaces, and positioned as close to the exterior of a building as possible.

D3043 – Steam Service Distribution

<table>
<thead>
<tr>
<th>Service</th>
<th>Pipe Material</th>
<th>Fittings</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam 2” and Under</td>
<td>Seamless Sch40</td>
<td>Welded Fitting</td>
<td>Welded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or threaded</td>
<td></td>
</tr>
<tr>
<td>Steam over 2”</td>
<td>Seamless Sch40</td>
<td>Welded Fitting</td>
<td>Welded</td>
</tr>
<tr>
<td>Condensate 2” and under</td>
<td>Seamless Sch80</td>
<td>Sch80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Threaded</td>
<td></td>
</tr>
<tr>
<td>Condensate over 2”</td>
<td>Seamless Sch80</td>
<td>Welded Fitting</td>
<td>Welded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sch80</td>
<td></td>
</tr>
</tbody>
</table>

1. High pressure steam traps shall be of bimetallic type, Bell & Gosett or Armstrong types preferred.
2. High pressure steam lines must be designed with double blocking and bleed.
3. For low pressure steam pipelines (less than 15p.s.i) ball valves are preferred, but gate valves are acceptable.

D3044 – Hot Water Distribution (Heating)

1. All hot water systems: Use full port ball valves up to 2”, use gate or globe valves for larger pipe sizes.
2. Valves in heating systems shall have seats and seals capable of resisting the attack from the water treatment chemicals.

Heat Exchangers

1. Heat exchangers shall normally be stainless steel plate exchangers, titanium plate exchangers to be used with systems that include ammonia.
2. Heat exchangers shall normally be:
   a. Fluid to Fluid: Stainless steel plate exchangers, titanium plate exchangers to be used with systems that include ammonia or water
   b. Steam to Fluid: Shell and tube heat exchangers
3. Heat recovery systems connecting exhaust and fresh air systems are preferred wherever possible.
4. Control valves for heat exchangers shall have pneumatic actuators.

D3045 – Chilled Water Distribution

1. All chilled water systems: Use full port ball valves up to 2”, use gate or globe valves for larger pipe sizes.
2. Valves in cooling systems shall have seats and seals capable of resisting the attack from the water treatment chemicals.

D3047 – Glycol Distribution Systems

1. Pipes and pipe fittings are to be in accordance with the following table:

<table>
<thead>
<tr>
<th>Glycol Piping</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Pipe Material</td>
<td>Fittings</td>
<td>Joints</td>
</tr>
<tr>
<td>Glycol propylene under 2” inside building or tunnel</td>
<td>Sch40</td>
<td>Threaded</td>
<td>Threaded</td>
</tr>
<tr>
<td>Glycol propylene 2” and over inside building or tunnel</td>
<td>Sch40</td>
<td>Mechanical Joint</td>
<td>Mechanical Joint or welded</td>
</tr>
</tbody>
</table>

D3043/44/45 – Chilled and Hot Water Piping

<table>
<thead>
<tr>
<th>Chilled and Hot Water Piping</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Pipe Material</td>
<td>Fittings</td>
<td>Joints</td>
</tr>
<tr>
<td>4” and under, inside building or tunnel</td>
<td>Sch40</td>
<td>Mechanical Joint (Victaulic)</td>
<td>Mechanical Joint (Victaulic)</td>
</tr>
<tr>
<td>Over 4”, inside building or tunnel</td>
<td>Sch40</td>
<td>Welded Fitting</td>
<td>Welded</td>
</tr>
<tr>
<td>Less than 2” inside building or tunnel</td>
<td>Copper Type</td>
<td>Wrought Copper/Black Iron</td>
<td>Soldered Joint/Threaded</td>
</tr>
<tr>
<td></td>
<td>L/Black Iron Sch 40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D3050 – Termination & Packaging Units

D3055 – Terminal Self Contained Units – Hydronic Coils and Radiators

1. Heat pumps shall be installed in separate rooms in new buildings for easy access and removal when required.
2. Provide a hose bib drain at all radiators that have supply and return mains above the radiators and on any other radiator that will not train through its piping.
3. Provide air vents and air separators at high spots in the piping systems.
4. Provide a (ball valve) shut-off valve at supply and return connections of radiators. Radiators need to be isolated to one unit. (Any hydronic coil should be isolated).

D3060 – Controls & Instrumentation

1. For building HVAC controls the design consultant shall discuss requirements with Owner and Johnson Controls. Johnson Controls, at no cost to the design team, shall work with the design consultant to fully engineer the system prior to tender. The Owner shall then decide how to procure the supply and installation from Johnson Controls.
2. Where variable speed function is required, VFDs (electronic type) shall be the acceptable standard of acceptance.
3. Control valves for primary systems shall have pneumatic actuators.
Pneumatic Air Compressor/Compressed Air Systems

1. The University has a central compressed air service with clean, dry, oil-free air that serves the majority of the campus. Where practical this system shall be used for compressed air. Where this is not practical compressed air shall be supplied. There are two systems, one for HVAC, and one for equipment use. Contact Facilities Management for direction to the appropriate source.

2. All new compressors shall be rotary screw type.

3. All new compressed air systems shall supply clean, dry, oil-free control air to the pneumatic control system.

4. Adequate air supply and exhaust shall be installed.

1. Pipes and pipe fittings are to be in accordance with the following schedule:

<table>
<thead>
<tr>
<th>Service</th>
<th>Pipe Material</th>
<th>Fittings</th>
<th>Joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed air – main distribution 2” and over</td>
<td>Sch40</td>
<td>Socket Weld</td>
<td>Welded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or butt weld</td>
<td></td>
</tr>
<tr>
<td>Compressed air – main distribution under 2”</td>
<td>Sch40/Copper Type L</td>
<td>Malleable Iron</td>
<td>Threaded</td>
</tr>
<tr>
<td>Compressed air lab/HVAC control under 2”</td>
<td>Sch40/Copper Type L</td>
<td>Copper</td>
<td>Siflos</td>
</tr>
</tbody>
</table>

D3063 – Heating/Cooling Air Handling Units

1. Variable speed drives should be used for fans to vary air flow.

2. Control valves on air handling units shall have pneumatic actuators. Provide local isolation valves for coils.

3. An air pressure sensor shall be provided in supply air ducts near fan discharge, to indicate dropped fire dampers or other obstructions in the supply duct system.

4. A differential pressure sensor shall be provided across each air filter bank.

D3064 – Exhaust & Ventilating Systems

1. Venturi valves only be specified in critical airflow applications – multi-function labs, chemical wet labs, heath care environments, etc. In environments where critical airflow is not required (offices, meeting rooms, classrooms, lounges etc), standard VAV boxes should be used. Clarification should be sought from Facilities Management on a case by case basis.
D3067 – Energy Monitoring & Controls

1. All utility expenditures in new buildings must be metered and connected via electronic data conversion to the University Energy Management Control System (Johnson’s Controls). These are the units and their compulsory units of measurement;

- Electricity: Kilowatts/Kilowatt hours (KW/KWh)
- Water: Litres/Min
- Condensate: Litres/Min
- Chilled Water: Kilowatt hours (hWh)
- Hot Fluid: Kilowatt hours (kWh)
  - (Water, Glycol/Water)
- Steam: Lbs/hour
- Solar Thermal: Kilowatt hours (kWh)
  - (air or water)