1 Pipe Penetrations
1.1 All pipe penetrations through interior walls will be sealed to prevent air transfer.

*Note:* Interior wall holes that are oversized can make pressure control difficult.

2 Pressure sensing locations
2.1 Each main line strainer and each heat exchanger needs a pressure sensing point with gage cock at the inlet and outlet.
2.2 To the extent possible all pressure sensing locations should be piped to a common pressure gauge.

*Note:* Using a single pressure gauge provides an accurate differential pressure measurement even when the gauge has lost calibration.

*Exception:* Small items (fan coil units VAV box reheat coils, etc.) may have PT plugs instead of gauges.

3 Thermometers
3.1 Each device using chilled or heating water should have thermometers at the inlet and outlet.

*Note:* Reading the heat exchanger differential pressure and temperature is critical for field verification of exchanger operation.

*Exception:* Small items (FCUs, VAV box reheat coils, etc.) may have PT plugs instead of a thermometer.

4 Balancing valves at the pump discharge
4.1 System designed to be constant volume should have a VFD controlling the speed to eliminate the need for balancing or triple duty valves.

*Note:* Using balancing valves to restrict flow uses more energy than using a VFD to reduce the pump speed.

5 Automatic flow controllers
5.1 Automatic flow controllers should be installed at the heat exchanger level.

*Note:* At the heat exchanger level, though Automatic Flow Controllers restrict the operating range of control valve by about 20% they are still the preferred approach for preventing pump overflow and limiting the time required by the balancing contractor.

6 Manual Balancing Valves
6.1 Systems designed to be variable flow should have few, if any, manual balancing valves.

*Note:* Unnecessary balancing valves add pressure to the system wasting energy.

6.2 When a control valve is present manual balancing valves are not to be used at the heat exchanger level.

6.3 When using manual valves to balance a circuit they must have be fully repeatable position (memory stop) globe valves as opposed to simple circuit balancing valves.

7 Isolation Valves
7.1 Install isolation valves at main piping distribution that isolating building sections, at all branch lines off main pipes, at all pieces of equipment, and at specialty items.

8 Piping
8.1 Pipes can be Type L copper or schedule 40 black steel.

*Note:* Be aware of electrolysis. Steel acts as an anode, giving up ions to the copper, the cathode. Thus, a system with a small amount of steel to a large quantity of copper will have premature failure of the steel pipe.

8.2 Water velocity shall not exceed 10 FPS.

*Note:* Velocities of 10 FPS will erode the pipe.

8.3 Pipe size should not be less than ¾”.

8.4 The first fitting inside a building must be a welded fitting.

*Note:* When the system is subjected to a pressure spike (as occasionally happens) this first fitting inside the basement takes the brunt of the pressure spike and has been known to catastrophically fail.

8.5 Other than the first fitting, grooved mechanical couplings may be used inside a building.

8.6 Mechanical compression couplings may be specified as a deduct alternate.

8.7 Comply with ASHRAE 90.1-2013 Table
6.5.4.6 Piping System Design Maximum Flow Rate in GPM when sizing hydronic piping systems as modified and listed in table below:

<table>
<thead>
<tr>
<th>Operating Hours/Year</th>
<th>≤ 4,400 Hours/Year</th>
<th>&gt; 4,400 Hours/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Pipe Size, in.</td>
<td>Other</td>
<td>Variable Flow/Variable Speed</td>
</tr>
<tr>
<td>2 1/2</td>
<td>85</td>
<td>130</td>
</tr>
<tr>
<td>3</td>
<td>140</td>
<td>210</td>
</tr>
<tr>
<td>4</td>
<td>260</td>
<td>400</td>
</tr>
<tr>
<td>5</td>
<td>610</td>
<td>470</td>
</tr>
<tr>
<td>6</td>
<td>570</td>
<td>860</td>
</tr>
<tr>
<td>8</td>
<td>900</td>
<td>1400</td>
</tr>
<tr>
<td>10</td>
<td>1300</td>
<td>2000</td>
</tr>
<tr>
<td>12</td>
<td>1900</td>
<td>2900</td>
</tr>
<tr>
<td>*14-24</td>
<td>6.5 ft/s</td>
<td>9.5 ft/s</td>
</tr>
</tbody>
</table>

*Maximum velocity for pipes over 14-24" NPS.

9 Utility meters
9.1 When new buildings are being designed multiple utilities supplied to the facility are to be individually metered including chilled water.

10 West Lafayette Chilled Water Design Data
10.1 Supply Temperature

10.1.1 Summer: 45°F is supplied to the building wall with good reliability (the system is above 48°F less than 2% of the time).

Note: The designer must take into account temperature rise inside the building.

10.1.2 Winter: 47°F is the winter basis of design

Note: The winter supply temperature is more likely to drift

10.2 The design return temperature is 63°F LWT from the coil

10.3 Differential Pressure

- 10 psig summer
- 15 psig winter

11 Chilled Water Pipe Coating
11.1 Corrosion resistant paint should be applied to all steel chilled water pipe prior to being covered with insulation.

12 Strainer screens size table

<table>
<thead>
<tr>
<th>Use</th>
<th>Pipe Size</th>
<th>Screen Size</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>2&quot; and smaller</td>
<td>0.033 perforations (1/32&quot; or 20 mesh)</td>
<td>250 PSI</td>
</tr>
<tr>
<td></td>
<td>2 1/2&quot; and larger</td>
<td>0.045 perforations (3/64&quot; or 16 mesh)</td>
<td>125 PSI</td>
</tr>
<tr>
<td>Water</td>
<td>2&quot; and smaller</td>
<td>0.062 perforations (1/16&quot; or 10 mesh)</td>
<td>250 PSI</td>
</tr>
<tr>
<td></td>
<td>2 1/2&quot; to 4&quot;</td>
<td>0.062 perforations (1/16&quot; or 10 mesh)</td>
<td>125 PSI</td>
</tr>
<tr>
<td></td>
<td>5&quot; and larger</td>
<td>0.125 perforations (1/8&quot; or 7 mesh)</td>
<td>125 PSI</td>
</tr>
</tbody>
</table>

Note: Frequently contractors purchase one screen size for an entire project, or a strainer with a screen sized for steam is used for a hydronic system. When done the strainer clogs quickly. When followed this table avoids this problem.

13 Closed Loop Air and Sediment Control
13.1 Closed loop hydronic systems shall be installed with combination air eliminator/dirt separator with flanged, removable head for bundle removal for the purposes of cleaning and inspection; isolation valves; and integral drain valve for manual system flushing.