

DIVISION 15 – MECHANICAL

A. GENERAL DESIGN CONDITIONS

1. Design occupied spaces to maintain 72°F and a space dew point temperature not to exceed 55°F.
2. Design classroom and office space buildings with Variable Air Volume (VAV) air handlers.
3. Chilled water coils controlled by both space dry bulb and space dew point (or relative humidity) are preferred.
4. Coils for comfort heating in the re-heat position are preferred.
5. Where practical, provide return and outside air ducts and dampers capable of economizer operation.
6. VAV boxes shall be selected with hydronic re-heat coils.
7. Utilize campus steam (where available) to heat hydronic heating water.

B. AIR HANDLING UNITS

1. All new air handling units shall be Variable Air Volume (VAV) with terminal re-heat utilizing hot water coils.
2. All new air handling unit cooling coils shall be chilled water cooling coils as follows:
 - a. Casing – minimum 16 gauge stainless steel
 - b. Tubing – minimum 0.020 inch thick wall thickness copper
 - c. Fins – minimum thickness 0/007 inches- continuous sheet, solid fin fabrication-copper or aluminum
 - d. Fin density – no more than 10 fins per inch
3. Coil selections shall utilize 48°F chilled water supply. Coils shall be of counter flow configuration. All new air handler unit casings shall be double wall construction. Wall panels shall have a minimum R-Value of 13.0 BTU/°F·ft² and shall be capable of withstanding 5 inches of water gauge of differential static pressure without permanent deflection.
4. Access panels shall be removable, bolt on hinge and with a gasket.

5. All new air handling units shall have pleated high efficiency media in angle filter racks or shall be bag type. Filter Face Velocity shall not exceed 300 feet per minute.
6. All new air handling units shall have stainless steel secondary safety pans. Pans shall allow 3" clearance on all sides of the unit footprint. Pans shall be a minimum of 3" deep all welded seam construction.
7. Pipe secondary drain pans to most convenient sanitary sewer storm drain. Allow a minimum ½" air gap to drain overflow rim.
8. Secondary drain pans shall lay flat on concrete house-keeping pads, minimum 3½" high. Pads shall have 1" chamfer on all sides and shall completely contact entire drain pan bottom. Provide block outs in pads and bottom drain connections on secondary drain pans. (Detail sketches of Unit/Pan/Pad configurations are available for review.)
9. AHU fans shall be selected to provide no greater than 2 inches water gauge external static pressure.
10. AHU fans shall be modulated using variable frequency drives (VFDs). Use of inlet valves or discharge dampers is unacceptable.
11. Balance contractor shall set up system to operate at minimum required external static pressure on prime moving fans.
12. Air handling equipment may not be placed on rooftops.

C. AIR HANDLING UNIT PIPING

1. All coils 10 Total Tons and lower shall be piped with Type L hard drawn copper.
2. All cooling coils shall be trapped according to manufacturer's recommendation and piped to the most convenient sanitary waste or storm drain with adequate means.
3. All water coils shall have union or flanged connections to expedite future coil replacement.
4. All water coils shall have shut-off service valves in supply and return run outs. Service valves shall be for isolation purposes only.
5. All water coils shall have a strainer with a valve blow down piped to the most convenient sanitary sewer.

6. All water coils shall have thermometers in thermometer wells and pressure gauges with gauge cocks in both the supply and return run outs. Return run out pressure gauges shall be down stream of all control and balancing devices. An additional gauge cock and plug shall be installed between the discharge of the coil and any control or balancing device.
7. All air unit control valves shall be three way and shall be located in the return piping.

D. TERMINAL HEATING PIPING

1. All terminal reheat coils on both constant and variable air volume systems shall have isolation valves in the supply and return run outs.
2. Shut off valves shall be for isolation purposes only.
3. Pipe re-heat coils with union of flanged joints to expedite coil change out.
4. Provide an independent strainer for each coil run out. Strainer shall have a valve blow-down with a capped hose-bibb connection.
5. Provide capped and P&T plugs up stream and down stream of the strainer, the coil, the flow control valve, and the flow balancing valve.
6. In variable volume pumping systems provide two-way control valves at each coil and three way valves for the most remote locations suitable to handle 20% of the total re-heat system volumetric flow rate.
7. Re-heat systems should be designed for 180°F supply and 160°F return temperatures.

E. DUCTWORK

1. All ductwork shall be constructed to SMACNA and ASHRAE standards.
2. All ductwork shall be galvanized sheet steel construction, except for special ducts carrying corrosive or dangerous fumes.
 - a. Special duct systems shall be specifically called out in construction documents.
 - b. Designer shall consult with the Planning, Design & Construction department concerning all special duct systems.
3. All ductwork shall be flange connected or lock seam connected with mastic sealed joints.

4. All ductwork carrying air below ambient temperature shall be wrapped with 2" minimum thickness, 1½ pound density duct wrap with reinforced, foil vapor barrier.
 - a. Ductwork serving acoustically sensitive areas may be lined.
 - b. All lined duct shall be specifically called out in construction documents.
 - c. Designer shall consult with the Office of Facility Development concerning all acoustically lined ductwork.
5. Ductwork shall not be run over electrical panels, electrical switch boards or the working clearances of such items.
6. All rectangular duct take-offs shall be SMACNA standard angle take-offs.
7. Provide manual balancing dampers with locking quadrants at each duct take off. Splitter dampers are not acceptable.
8. All dampers shall be high efficiency, low leakage type.
9. All supply air diffusers shall be insulated with minimum 1" thick duct wrap.
 - a. Duct wrap on supply air diffusers shall have vapor barrier on ambient air side.
 - b. Seal duct wrap vapor barrier to supply air diffuser edge.

F. COOLING TOWERS

1. All Cooling Towers shall be induced flow design.
2. Distribution (hot) basins and collection (cold) basins shall be of stainless steel construction.
3. Sleeve bearings are unacceptable.
4. Drives shall be gear type only.

G. PIPE IDENTIFICATION

Piping shall be identified as follows:

Chilled Water Supply	Dark Blue
Chilled Water Return	Light Blue
Condenser Water Supply (From cooling tower collection basin to chiller condensing barrel)	Dark Green
Condenser Water Return (From chiller condensing barrel to cooling tower distribution basin)	Light Green

Steam	Dark Grey
Steam Condensate	Light Grey
Natural Gas	Yellow (ANSI Standard)
Chemical Feed	Purple
Heating Water Supply	Brown
Heating Water Return	Tan
Fire Suppression Systems	Red
Fire Suppression Systems Distribution	Red or to match architectural features

Provide ANSI standard labels at wall, floor and ceiling/roof penetrations and every 15 feet in machine rooms.

Provide direction arrows at all changes in direction and at labels.

H. PUMPS

1. Hydronic Pumps

- a. Hydronic pumps shall be close coupled base mounted or horizontal split case type. Vertical split case pumps will be considered if foot print is limited in order to provide for sufficient access.
- b. All hydronic pumps of five (5) horsepower and above shall have adjustable frequency drives sufficiently sized to accommodate operation at 125% design flow and 156% of design head.
- c. All hydronic pumps of five (5) horsepower and above shall have impellers sized to accommodate operation at 125% design flow and 156% of design head.
- d. Select all pumps to operate within 10% to the right of maximum efficiency point (MEP) and 15% to the left of MEP.

I. INSULATION

1. Above Grade Piping Insulation (all thicknesses and installation procedures as recommended by material manufacturer)
 - a. Chilled Water Piping
 - Steel piping shall be insulated with foam-glass insulation.
 - Copper piping shall be insulated with elastomeric foam insulation.
 - b. Heating Water Piping shall be insulated with preformed fiberglass pipe insulation.
 - c. Domestic Cold, Hot and Hot Return Water Piping shall be insulated with preformed fiberglass pipe insulation.
 - d. Steam and Steam Condensate Piping shall be insulated with preformed fiberglass pipe insulation.
 - e. Condensate lines from Air Handling Units and Ice Making Machinery shall be insulated with elastomeric foam insulation.
 - f. Direct Expansion Cooling Piping shall be insulated with elastomeric foam insulation.
2. Below Grade Piping Insulation (all thicknesses and installation procedures as recommended by material manufacturer).
 - a. Chilled Water Piping shall be pre-insulated piping with aluminum exterior PVC lagging.
 - b. Steam and Condensate Piping shall be pre-insulated piping with aluminum exterior PVC lagging.