

SECTION 15850
AIR HANDLING

A. GENERAL

1. Provide 4” concrete pad for floor mounted equipment.
2. Provide outdoor air in accordance with the current edition of the Indiana Mechanical Code.
3. Provide all hardware and controls required to utilize outdoor air for “free” cooling in compliance with the latest edition of the Indiana Energy Code.

B. PACKAGED ROOFTOP AIR CONDITIONING UNITS

1. Use packaged rooftop HVAC units on small buildings with relatively low loads and when the central chilled water loop is not easily accessible. Consult with IU Engineering Services prior to specification of rooftop HVAC units.
2. Install reverse cycle heat pumps for heating/cooling duties when central steam or gas is not available. Use hot water for supplementary heat if economic and available, otherwise use electricity.

C. AIR HANDLING UNITS

1. General
 - a. Preference is for variable air volume systems.
Select fans and motors for high efficiency, and low noise generation. In VAV systems 5 hp and larger, provide motor with variable frequency drive. Variable pitch sheaves are not required when furnishing variable frequency drive.
 - b. For belt driven fans provide adjustable sheaves for balancing. Balancing contractor to remove adjustable sheaves and install fixed sheaves after Engineer approves final balance report
 - c. Provide mixing box with sufficient space to allow mixing of outside air and return air, or provide air mixing devices. Air blenders should be considered to eliminate possible stratification.
 - d. Construct casing from double wall insulated galvanized steel.
 - e. On new buildings and large-scale renovations, investigate the option of using a separate outside air handling system.

- f. Use heat recovery where economical. Energy savings payback calculations should be provided and reviewed by IU engineering services for all heat recovery systems.
 - g. Use factory package unit to 40,000 cfm. Use built-up unit for larger air quantity. Avoid arrangements that require coils and dampers that are wide compared to height - maximum ratio 3 to 1.
 - h. At IUPUI, provide circulating chilled water coil pumps or freeze protection on AHU's designed with large percentage (greater than 40%) of outside air.
 - i. Refer to Section 15950.E for coil freeze protection.
 - j. AHU cabinet shall be double wall with minimum of 2" thick insulation. Internal parts of coil sections should be all stainless steel when possible.
2. Air Heating/Cooling Coils
- a. Coils shall be of cartridge type, removable from the header side of the casing.
3. Steam Coils
- a. Non-freeze steel or copper tubes, aluminum fins. 8 fins per inch maximum. Provide vacuum breakers, steel headers.
 - b. Steam coils with integral face and by-pass dampers are preferred in all outside air systems.
4. Water Coils, Glycol Coils
- a. Copper tubes and aluminum fins, headers of copper seamless tube. 8 fins per inch maximum. Specify straight fins for heating coils to facilitate cleaning. Air velocity across cooling coil not to exceed 500 feet per minute. Pipe water and air flow in counterflow arrangement. Provide balance valve for each section of coil.
5. Refrigerant Coils
- a. Copper tubes and aluminum fins.
6. Electric Coils
- a. Specify open wire type, 80% Nickel, 20% Chromium resistance coils except 100% outside air. Use finned tubular coils for outside air. Modulate heat output by varying the number of coils turned on in incremental sequence. SCR controllers are prohibited.

7. Drain Pans

- a. Double wall, insulated stainless steel pans sloped in two directions. Provide condensation drain pans below chilled water, glycol and refrigerant coils. Provide intermediate drain pan as described above with copper drain line extended to lower pan. The drain pans at floors shall be depressed below the air handler floor level to prevent overflow.

8. Humidifiers

- a. Steam injection is the preferred method of space humidification. Campus steam should not be used directly. Provide steam-to-steam exchanger to generate steam that is free of boiler treatment chemicals. Pressure Vessel type exchanger shall be ASME Pressure Vessel with copper shell lining, copper tubes and heads, and insulated shell. Non-pressure type exchanger shall be stainless steel construction with copper tubes and heads, insulated cabinet, and surface skimmer.
- b. Interlock humidifier control with air handler control so that humidifier shuts down whenever air handler fan is off.

9. Dehumidifiers

- a. Use dehumidifiers only for process or critical conditions.
- b. Direct expansion refrigerant coil is preferred for dehumidification at IUB and regional campuses. At IUPUI, dehumidification systems with refrigerant coils are not desired. Desiccant dehumidification using rotary enthalpy heat exchangers or heat wheels should be considered.

10. Air Filters

- a. Specify pleated disposable prefilter 25-40% dust spot efficiency and filters 80-85% dust spot efficiency according to ASHRAE Standard 52-76, for computer and data processing areas, medical research areas, laboratories, and libraries.
- b. In other areas specify pleated disposable filters, with 25-40% dust spot efficiency according to ASHRAE Standard 52-76.
- c. At IUPUI utilize a single bank of 2 in thick, 30% efficient filters in the pre-filter location for office/meetings/classroom areas. For classrooms and office areas final filters shall consist of pleated throw-away type filters with an efficiency

range of 65-85%. If the AHU serves labs or research areas final filters shall consist of either 90-95% efficient filters or HEPA filters.

11. Ultraviolet light emitters

- a. At IUPUI, consider specifying ultraviolet light emitters in AHU systems to eradicate mold, bacteria, viruses, and other pathogens that grow and circulate in HVAC systems.

D. VAV BOXES

1. Do not use 100% shutoff in occupied area, but provide minimum air flow for ventilation requirements. Use hot water reheat. DDC controls with pneumatic actuation preferred at Bloomington only—provide electric actuation at IUPUI. Use of fan-powered boxes is discouraged due to high maintenance and noise. If fan-powered boxes must be used please specify parallel type which operates intermittently.
2. VAV boxes should be pressure independent type provided with pressure tabs and air flow curve for making air flow and pressure measurements for testing and balancing purposes.
3. At IUPUI, VAV boxes shall have double wall metal liner so that no duct liner is exposed to the supply airstream. The intent of the double wall liner is to guard against bacteria and mold growth and future deterioration of liner material. The double wall liner will also prevent liner material from getting out into the duct system and building spaces.

E. DUCTWORK

1. Ductwork for Air Conditioning and Ventilation

- a. Follow SMACNA design and construction standards. Specify galvanized steel.
- b. Design elbows and turns in ductwork to have throat radii not less than the diameter or width of the duct. Where there is insufficient clearance to allow this minimum radius, use square elbows with single sheet, single thickness, and factory fabricated turning vanes. Reinforce ductwork externally.
- c. Smoke detectors should be installed as per Section 16721 of this standard and in general as follows:

Units below 2000 CFM; no smoke detectors required.

Units 2000 CFM and below 5000 CFM: Install one smoke detector in the unit. Favor a supply side location, with the exception of a unit with high efficiency filtration system, then the detector should be located on the return side.

Units 5000 CFM and above: Install smoke detectors in both the return air and the supply air.

In air handling units with multiple supply ducts off the supply plenum, multiple detectors should be used if a single acceptable location is not available.

2. Special Ductwork

- a. Ductwork for chemical fume hoods shall be constructed of stainless steel, PVC coated steel or solid PVC as required for the type of service.
- b. Duct work serving perchloric acid hoods shall be constructed of welded stainless steel and shall be installed with a complete washdown and drain system. Perchloric acid exhaust systems shall be independent of other building exhaust systems.
- c. Radioisotope hoods should be on a separate exhaust system from other hoods and have stainless steel ducts. Make provision for filters to be installed at hood outlet if required, and select the fan accordingly.
- d. Solid PVC ductwork shall be specified for acid digestion type exhaust systems.
- e. Dishwasher, cage washer and all other wet exhaust system ductwork shall be welded stainless steel sealed watertight, and sloped to drain connections at low points. Duct section joints shall be welded. Flange construction shall be bolted with silicone foam rubber gasketing.

3. Flexible Connections

- a. Connect inlet and outlet ductwork to fans and air handlers with flexible duct connections.
- b. Length of flexible duct to an air outlet not to exceed 6 feet.
- c. Do not use flexible duct for exhaust and return system.

4. Duct Hangers and Supports

- a. Support ductwork in accordance with the SMACNA Duct Construction Standards.

5. Access Doors

- a. Access doors or panels must be hinged-type and be provided in ductwork for maintenance and service of filters, heating coils, soundtraps, volume dampers, fire dampers, humidifiers, etc. Coordinate location of inaccessible equipment with Architect.
- b. Provide a minimum 24" x 24" access door in inaccessible ceilings and walls for access to mechanical equipment.
- c. Provide for service access to airflow measuring stations and duct mounted reheat coils.
- d. Provide duct access panels in supply air and return air main trunk ducts in locations spaced approximately 40 feet apart to allow for future duct cleaning.

F. FREEZE PROTECTION ON AIR HANDLER WATER COILS

1. Coil Circulating Pump: Install a circulating pump to circulate water through the first upstream coil. Size the circulating pump to ensure about 2 ft/sec. tube velocity.
2. Sensors: Install freezestats (low limit controllers) to detect freezing air conditions. Set freezestat alarm temperature at 35 degrees F. Provide sufficient freezestats so that each monitors no more than a 3 feet wide path of air. Install freezestat on upstream face of chilled water coils. Wire freezestats in series so that any can trip the safety circuit.
3. Provide an aquastat in chilled water coil return piping. Set alarm temperature at 40 degrees F.
4. Control Response: When outside air temperature drops below 35 degree F enable the coil circulating pump. Disable the coil circulating pump when outside air temperature rises above 38 degree F. Discuss pump on/off sequence with IU Engineering Services.
5. In the event of a freezestat or an aquastat alarm close outside air dampers and shut down supply fan. If there is a return air system shut down the return air fan, open return air dampers, and close relief dampers. Alarm campus control center of alarm conditions. Manual reset following alarm conditions is required.

6. Return/Outdoor Air Mixing: Ensure sufficient duct length or install air mixing devices to ensure air temperature uniformity within 10 degree F across a section of the duct immediately upstream of the chilled water coils.

G. DIFFUSERS AND GRILLES

1. Refer to Section 15010- A-10 for noise criteria. Consider air patterns when selecting diffusers for both heating and cooling.
2. At IUPUI square ceiling diffusers (SCD's) are preferred in lieu of linear slot diffusers. SCD's shall be similar to Titus OMNI model. If linear slot diffusers are required please specify units similar to Titus TBD-30 model with modulinear pattern controllers.

H. FAN COIL UNITS

1. Fan coil units should be provided with an inlet grille to prevent dislodging of filter. High efficiency motors should be specified along with Hi-temperature rise coils. Consult IU Engineering Services for fan coil unit system design.