



DESIGN REQUIREMENTS

AIR HANDLING UNITS

GENERAL INFORMATION

1.1 This section applies to air handling units for HVAC Systems.

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2.1 Design Criteria

- a. The decision to use modular central station air handling units versus custom will be made on a project-by-project basis. However, for general duty up to approximately 20,000 CFM modular is acceptable.
- b. The Engineer will submit pressure drop calculations justifying the static pressure selection for each unit upon the University's request.
- c. When requested the Engineer shall submit a psychometric chart for each air handling unit with the following temperatures plotted: outside and indoor design condition, entering and leaving coil conditions and room sensible heat factor line, for each unit upon the University's request.
- d. Indicate on machine room drawings an accurately scaled air handling unit, include with subdivisions indicating individual sections and access sections.
- e. Indicate coil pull space on Drawings.
- f. When sizing air handling unit, the Engineer shall include in their consideration duct leakage (5%), resistance to loaded filters, wet coils, and additional capacity.
- g. Designer shall coordinate the locations of AHU's with consideration to objectionable noise and access. Units located on other than slab on grade shall be supported on materials that provide a sound deadening mass. Maximum structural deflection shall not exceed $\frac{1}{4}$ ".
- h. When variable airflows are required, use variable frequency drives, not inlet vanes.
- i. Insure that the steam coil location or unit mounting height above the floor will allow a minimum vertical drop of 12" from the discharge of the steam coil to the trap inlet. The

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discharge from the steam trap shall then be pitched away from the trap so it can drain by gravity. Vertical lifts are not allowed.

- j. Coordinate adequate height for cooling coil condensate drain trap. Provide continuous I-beams under units, where condensate trap exits unit through the base rail. Coordinate with the plumbing designer so that there is a floor drain in the immediate proximity of the AHU cooling coil. Arrange piping so that it does not create a trip hazard.
- k. Design installation of units to allow access space around air handling units for service and maintenance and to allow a coil replacement. The isolation valves shall be arranged in such a way that they can be closed and piping between the valve and coil can be removed and the coil pulled out and replaced.
- l. Cooling coils shall not be selected for air velocity exceeding 500 feet per minute. Where velocities are higher moisture eliminators shall be considered to minimize potential of moisture carry over.
- m. Heating coils shall not be selected for air velocities exceeding 600 FPM.
- n. Provide minimum 12" vertical height above steam traps. The discharge of the steam trap shall then be pitched away from the trap so it can drain by gravity. Vertical lifts are not allowed on low pressure systems with control valves. A vacuum breaker and a safety valve on shell shall be provided on steam to water systems. A relief valve on tube side shall be provided before the isolation valves.
- o. Coordinate mounting, casing and sound trap noise and vibration requirements with acoustical engineer.

2.2 Winter Piping Considerations:

- a. Air handlers that use outside air and sequence of operations that makes use of chilled water 365 days a year shall have two (2) automatic shut-off valves installed in order to protect the chilled water supply in the event of coil failure.
- b. The automatic regulating valve may act as one of the shut-off valves, but a second valve must be installed in the supply or return line in order to completely isolate the coil in the event of a freeze condition.
- c. When hot water is used as a preheat medium, freeze protection is required.
- d. When a chilled water coil does not require water in the winter, a valve and flex hose arrangement shall be installed to provide warm air through the coil during the winter.



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- 2.3 Consultant shall specify that units are not allowed to be used for conditioning the building during construction unless express written consent has been provided by the University at the time of bid.
- 2.4 Equipment Requirements - AHU
- a. General
 - 1. AHU's shall be entirely of double wall galvanized steel construction.
 - 2. AHU cross sectional area shall be consistent throughout units length. Coil extensions outside unit profile are not acceptable.
 - 3. AHU's shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. At the University's request, select units shall be factory tested. The unit shall be disassembled into the largest sections possible subject to shipping and rigging restrictions.
 - b. Unit Casing
 - 1. Formed and reinforced galvanized 18 gauge (16 gauge on units 20,000 cfm and above) outer steel panels and floor, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Panels shall be removable without affecting the structure of the unit. 20 gauge solid galvanized steel liner in all sections, except fan and discharge sections shall be perforated. Floor liner is below unit to hold and protect insulation.
 - 2. Inner panel of floor shall be 16 gauge, with a 20 gauge insulation protector (below unit).
 - 3. Provide blank-offs where required to insure no air bypass between sections, through perforated panels or around coils or filters. Blank-offs shall be installed at each component of the AHU unit and also at the internal panels to prevent recirculation of the air through perforated panels. Seal any holes where bypass occurs.
 - 4. AHU's shall be designed to insure that there is no condensation on the exterior of the unit based on outside design conditions. Through metal connections between inner and outer panels shall be kept to an absolute minimum. If tubular structural members are used inside of the tube shall be insulated equal to casing.
 - 5. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections which may contain water or condensate shall be watertight with drain pan.

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6. Access panels and doors shall have the same materials, thickness, construction, and finishes as the cabinet and be complete with hinges, latches, handles, and gaskets. All doors shall have a 9" x 9" double pane view window. Door latch motion shall not exceed 180° and shall pull the panel snug to the frame door. Latches shall be metal.
7. Fan section shall have inspection and access panels and doors sized and located to allow periodic maintenance and inspections. Access doors into plug fan shall open into the fan section.
8. Casing construction and finish for outdoor units shall be suitable for exterior, rooftop installation with no leakage or other weather penetration. Roof shall have canting to allow proper draining.
9. Unit shall be designed such that when the modules are connected together, the gasket seal shall be made tighter.
10. The entire unit shall be mounted on factory fabricated or field erected continuous, base rail channels, or a housekeeping pad.

c. Coils General

1. Cooling and heating coils shall be factory tested for rating in accordance with ARI 410 – Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.
2. Coil section shall be designed and constructed to facilitate removal of coil for maintenance and replacement and to assure full air flow through coils. All coils shall be drainable, rigidly supported across the full face of the coil, and pitched to allow drainage.
3. Fins shall not be spaced more than 11 per inch.
4. Coils shall be hydrostatically tested to 200 psig.

d. Water Coils

1. All coil capabilities, pressure drops and selections procedures shall be certified in accordance with ARI Standard 410.
2. Plate fin type coils are preferred.
3. Water coils shall have 5/8" O.D., 0.035" thick copper tubes with aluminum plate fins. Headers shall be round copper pipe. Steel pipe headers are unacceptable. Coil frames shall be galvanized steel.

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4. Chilled water coils that utilize central campus chilled water must be selected for a temperature rise of 16F (45°F – 61°F).
 5. Coils shall have a threaded connection for air vent at high point in header.
- e. Steam Heating Coils
1. Distribution header coil fabricated according to ARI Standard 410.
 2. Non-freeze, distributing type steam coils shall be pitched in the unit casing to allow for proper drainage of steam condensate.
 3. Tube arrangement shall be 1" O.D. copper outer tube with 11/16" O.D. copper inner tube. Headers shall be cast iron with internal threaded connection. Steel pipe headers are unacceptable.
- f. Refrigerant Coils
1. Direct-Expansion Refrigerant Coils: Designed and fabricated in compliance with ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration." Provide seamless copper suction headers and distributor tubes. Venturi-type refrigerant distributor, designed for low pressure drop, arranged for down feed with solder connections, and having a maximum of 12 circuits for each distributor. Coils with more than 12 circuits shall have two distributors. Split circuit coils shall have two distributors.
 2. Coils shall be burst tested to 450 psig and proof tested to 300 psig air pressure under water.
 3. After testing, insides of coils are to be dried, all connections are to be sealed, and coil shall be shipped with a charge of dry nitrogen.
- g. Drain pan
1. Drain pans shall be formed sections of 316 stainless steel (where not available provide 10 gauge galvanized steel). The drain pan shall be sloped in two directions with the lowest single point at the drain connection(s). The cooling coil shall have a full width, sloped drain pan that extends downstream of the coil to provide sufficient amount of space to collect moisture carryover.
 2. Coils with finned height greater than 48" shall have an intermediate 316 stainless steel drain pan extending the entire length of the coil.
 3. Drain pan to be located high enough to function at design static pressure, with a trap and 2 inch air gap to floor drain.

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h. Supply/return fan

1. Fan shall be an AMCA rated double width, double inlet or plug centrifugal type mounted on a single shaft. Fan blades shall be backwardly inclined or backwardly curved air foil type.
2. The fan shall be statically and dynamically balanced as an assembly, at the design RPM.
3. Fan drives shall be of the "V" belt type, rated at 150 percent of maximum fan motor horsepower and shall provide for adjustment of both belt tension and alignment. Belt speeds shall not exceed 5100 fpm.
4. Provide variable-pitch sheaves on fans of 5 HP and smaller. Sheaves shall be cast iron, with multiple grooves for multi-belt applications.
5. Provide one spare sets of belts for each AHU fan.
6. Provide self-aligning, pillow block, grease type ball-type bearings. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in air stream to assure proper air flow.
7. See Section 23 34 00 - Fans for additional requirements.

i. Insulation

1. All factory fabricated air handling units shall be factory insulated with minimum of 1" thick, 1-1/2 lb. density fiberglass insulation.

j. Access Sections

1. Access sections shall be provided for access to filters, both faces of coils, and fan. Each access section shall have a full height, hinged, removable access door of a sufficient size (18" x 48") to accommodate a moderately sized man to service and repair the equipment. Each access door shall be properly gasketed to minimize air leakage. The door shall have "Ventlock" style metal handles operable from the inside and outside.
2. Access door swing shall open in the direction of higher pressure. Doors that do not open against unit operating pressure shall be provided with safety "Ventlock" style latches that allow the door to open approximately three inches and then require approximately 45-degree further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force equal to minimum of 12" of differential static pressure of 1½ times operating differential



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pressure, whichever is greater. Latch motion shall not exceed 180 degrees and shall seal and pull the unit snug to frame.

k. Electrical and lighting requirements

1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard and 60 watt light bulb, shall be installed in each section where there is access for maintenance, including service vestibules and fan section. A switch with pilot light outside the unit shall control the lights in each compartment with a red pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory installed in metallic conduit. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for a single point, 115 volt field connection to the building system.
2. Provide a convenience GFI duplex outlet next to one light switch.

l. Filter Section

1. Pre-filters shall be 30% (MERV 8) efficient based on ASHRAE test procedure.
2. Final filters to have an average efficiency rating of 85% (MERV 13) as measured by ASHRAE Standard 52-68. Initial resistance not greater than 0.65" of W.G. at 500 feet per minute face velocity.
3. Install a differential pressure gauge (Magnehelic) in all central air handling units across each set of filter banks. The sensing ports shall be so located on either side of the filter to provide an accurate average static pressure drop across the entire filter bank.
4. Furnish one additional complete set of pre and final filters for each air handling (AHU) unit.

CONSTRUCTION REQUIREMENTS

- 3.1 Manufacturer's representatives shall supervise start-up of units and provide letter confirming that units are installed in accordance with manufacturer's recommendations.
- 3.2 Install floor-mounted units on concrete housekeeping pads at least 4 inches high and 6 inches wider than equipment.
- 3.3 Provide fixed sheaves as required for final air balance.
- 3.4 Contractor shall protect all units from dirt/debris and moisture throughout construction.
- 3.5 All units shall be cleaned and a clean set of filters shall be installed prior to operation.



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REFERENCE

- 4.1 The applicable CSI Specification Section is 23 73 00.