

SECTION 23 70 00- CENTRAL HVAC EQUIPMENT

PART 1: GENERAL

1.1 PURPOSE:

- A. This standard is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. The responsibility of the engineer is to apply the principles of this section such that the University may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be justified through LCC analysis and submitted to the University for approval.

1.2 REFERENCES:

A. Codes and Standards:

1. ARI 410 – Standard for chilled water, hot water and steam coils
2. ARI 430 – Central Station Air Handling Units
3. AMCA 99 – Standards Handbook
4. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
5. AMCA 300 – Test Code for Sound Rating Air Moving Devices
6. AMCA 301 – Method of Publishing Sound Ratings for Air Moving Devices
7. AMCA 500 – Test Methods for Louver, Dampers, and Shutters
8. ASTM D4230 – Measuring Humidity with Cooled Surface Condensation
9. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems

1.3 REQUIREMENTS:

- A. Air Handling Units shall be designed to the specific requirements of the application: Recirculation or 100% Makeup.
- B. Test and rate chilled water, hot water and steam coils in accordance with ARI 410. Display certification symbol on units of certified models.
- C. Do not operate air handling systems for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation of representative.
- D. Air Handler fabrication shall conform to AMCA 99 and ARI 30 in the absence of direction in this standard.
- E. Provide air handling unit internal insulation having maximum flame spread rating of 25 and maximum smoke developed rating of 50.
- F. Provide air handler casings design, manufactured, and installed such that no condensation shall form on the exterior or interior surfaces (other than on cooling surfaces), including joints and seams.
- G. University preference is for factory built air handling units. If project conditions require, built-up air handling units may be used, but must be justified through LCC analysis and be approved by the University.

PART 2: PRODUCTS

2.1 AIR HANDLER CASINGS (FACTORY):

- A. General: Provide horizontal or vertical type factory-fabricated air handling units as indicated, of sizes and capacities as scheduled, and as specified herein.
- B. Construction: Each unit shall have a double wall airtight and weatherproof casing and shall be sectionalized for placement (indoors or outdoors). Provide a welded, full perimeter structural or tubular steel base frame with intermediate supports for all internal components. Provide thermal break construction between exterior panel and frame. Unit casings shall be insulated internally to provide minimum R-13 thermal resistance. Provide double bottom floor construction minimum R-13 thermal resistance and full walk-on interior non-skid surface.

- C. Performance: Unit casing shall be constructed, assembled, and factory tested to withstand operating pressure of 1.5 times the operating pressure or 6" w.g. positive (whichever is greater) with a maximum leakage rate of 1% of total airflow and deflection of 1/200th of the panel width or height.
- D. Coil Section: The coil section shall completely enclose the coil headers and return bends. Coil frames shall not be used as structural members of the coil section. The coil section shall be constructed in such a manner that the coils can be removed without affecting the structural integrity of the casing.
- E. Condensate (fin water) Drain Pan: Provide drain pans that meet all requirements of the latest version of ASRHAE 62.1. The drain pan shall be insulated, double wall type constructed of 304 stainless steel inner pan with stainless steel drain nipples and a galvanized, or painted, outer pan. Provide drain pans with 1" thick, 3 lbs. per cubic feet insulation between inner and outer pans. The drain pan shall extend under the complete cooling coil, hot water coil, steam coil, and humidifier section, including headers, and shall be rigid and watertight and sloped in 2 planes to accessible side of unit. Provide minimum 1½" male NPT stainless steel pipe drain connections extending 2" beyond the outside wall of the unit casing, or with drain connections as indicated on drawings. Drain pans shall not recess into floor of casing. Provide drain pans extending a minimum 2" downstream of coils, and provide downspouts and intermediate condensate collectors for stacked coil banks. Pans shall not be recessed into unit casing. Refer to 5.22.20 Water Recovery for fin water recovery and piping requirements.
- F. Access: Provide double wall insulated walk-in access doors with full perimeter gaskets in each casing section. Provide doors with windows, continuous stainless steel hinges, and quick opening handle with locking latch. Doors shall be 24" wide and full height of wall panel or maximum 72" tall, except where indicated otherwise on drawings. 18" wide access doors may be considered for space considerations where approved by the University.
- G. Filter Gauges:
 1. Provide surface mounted magnahelic gauge for each pre-filter and final filter bank, with integral leveling screw and graduated to read appropriate pressure range based on maximum dirty filter pressure loss.
 2. Provide pressure tips, tubing, gauge connections, and mounting bracket.

2.2 AIR HANDLER CASINGS (BUILT-UP):

- A. Assembled casing shall be double wall, airtight, with minimum 16 gauge thickness galvanized steel outer wall insulated throughout with minimum R-15 insulation. Inner wall shall be solid galvanized sheet metal, of a minimum of 18-gauge thickness. There shall be a thermal break between all inner and outer panels.
- B. Provide drain pans that meet all requirements of the latest version of ASRHAE 62.1. The drain pan shall be insulated, double wall type constructed of 304 stainless steel inner pan with stainless steel drain nipples and a galvanized, or painted, outer pan. Provide drain pans with 1" thick, 3 lbs. per cubic feet insulation between inner and outer pans. The drain pan shall extend 12" downstream of cooling coil and shall also extend under complete hot water coil, steam coil, and humidifier section, including headers, and shall be rigid and watertight and sloped in 2 planes to accessible side of unit. Provide minimum 1½" male NPT stainless steel pipe drain connections extending 2" beyond the outside wall of the unit casing, or with drain connections as indicated on drawings. Drain pans shall not recess into floor of casing. Provide drain pans extending a minimum 24" downstream of coils, and provide downspouts and intermediate condensate collectors for stacked coil banks.
- C. Casing Section shall have a complete perimeter channel base of at least 6" concrete pier or 6" galvanized steel or 6" carbon steel with marine quality primer. All floors shall be insulated with minimum R-10 insulation with 16 gauge non-skid galvanized floor. An 18 gauge galvanized sheet shall enclose and form a vapor barrier for the insulation on the bottom of the unit. All points of contact between the floor, vapor barrier and structure shall be thermally isolated with gasketing of closed cell soft rubber or EPDM.
- D. Access doors shall be provided to allow access to both sides of all coils. Access doors shall be double wall insulated, and the opening framed. Door size shall be at least 24" wide and full height of the panel up to 5'-0" tall with a minimum of 8" by 6" double glazed view window, capable of withstanding the total developed pressure of the unit. All access doors shall open against air pressure, unless approved by the owner in writing. All doors opening outward of casing shall have heavy-duty pull handles separate from latches.

E. Panels shall be double wall, reinforced construction with sufficient internal bracing to prevent excessive deflection of the panels. Unit casing shall be constructed and assembled to withstand operating pressure of up to 6" w.g. positive with a maximum leakage rate of 1.5% of total airflow and deflection of 1/250th of the panel width or height.

1. Minimum Casing Sound Transmission Loss (dB) per ASTM E-90 & E-413:

Octave	2	3	4	5	6	7	STC+
Perf Liner	22	26	37	44	53	55	39
Solid Liner	22	38	49	50	57	62	42

2. Minimum Casing Sound Absorption Coefficients per ASTM C-423 & E-795:

Octave	2	3	4	5	6	7	NRC+
No Liner	.26	.71	1.09	1.02	.96	.83	.95
Perf Liner	.25	.79	1.06	1.06	1.04	.78	1.00

3. Full sound performance data shall be submitted to the Project sound consultant for evaluation. Unit shall be finally configured so as to not exceed the room NC values as recommended in ASHRAE HVAC Applications.

2.3 CHILLED WATER COILS: (100% MAKEUP)

A. Chilled water coils shall meet all conditions and have the minimum face area and pressure drops scheduled on the Drawings, and shall have same-end supply and return connections unless otherwise indicated.

1. Coils shall be constructed of seamless, hard-drawn copper tubes $\frac{5}{8}$ " O.D. with 0.035" thick minimum wall thickness.
2. Continuous, flat, unenhanced plate type copper fins permanently bonded to the tubes by mechanical expansion of the tubes. Coil assemblies shall be maximum 6 rows deep. Coils shall have maximum 8 fins per inch. Fins shall be 0.010" thick copper.
3. Fins shall have full drawn collars to provide continuous surface cover over the entire tube surface such that no bare copper tube is visible between fins.
4. Return bends on coil tubes shall be full size, seamless copper tubing with .025" wall thickness. Coil tubes shall be 1½" center-to-center distance with adjacent rows staggered ½ the pitch distance, i.e., ¾".
5. Coils shall be counter flow, single-circuit, and serpentine with full face-feed headers. Coil headers shall have splayed connections.
6. Water coils shall be circuited for complete drain ability.
7. Internal tube baffles or turbulators are not acceptable.
8. Internal tube grooves or rifling's are not acceptable.
9. Stacked coils shall be independently demountable and supported on internal racks
10. Face velocity shall be 400 - 450 f.p.m at unit design airflow.

B. Coil headers shall be of heavy gauge seamless hard drawn copper tubing.

C. Supply and return connections shall be of Schedule 80 extra heavy; Alloy 85 red brass pipe terminated with male National Pipe Threads and shall be arranged with supply at the bottom, return at the top and separate vent and drain openings.

D. Coil connections or nozzles shall be of the same diameter, (or larger), as the coil headers.

- E. Each coil assembly shall have factory installed drain and vent connections.
- F. Coil casings shall be constructed with end flanges of sufficient depth to extend beyond and completely protect tube U-bends. The coil casing shall be constructed entirely of type 304 stainless steel, minimum 16 gauge. Intermediate tube support sheets shall be provided in all coils having tube lengths in excess of 60" and on long coil sections the spacing of coil supports shall be equally spaced and not exceed 60". All bolts, washers, lock washers, nuts, and other fasteners, brackets, or supports shall be stainless steel.
- G. Maximum tube length shall not exceed 156". Maximum Fin length shall not exceed 48".

2.4 CHILLED WATER COILS: (RECIRCULATION)

- A. Chilled water coils in recirculating units shall be the same as 100% makeup units with the following exceptions:
 - 1. Aluminum fins are acceptable.

2.5 HOT WATER COILS: (100% MAKEUP)

- A. Hot water coils shall be constructed the same as chilled water coils except they shall be two row and shall use a minimum 16 gauge galvanized material for casing construction. Fins shall be 0.010" thick minimum.
- B. Face velocity to be no greater than 500 fpm.

2.6 HOT WATER COILS: (RECIRCULATION)

- A. Hot water coils in recirculating units shall be the same as 100% makeup units with the following exceptions:
 - 1. Aluminum fins are acceptable.

2.7 STEAM COILS:

- A. Steam coils shall be non-freeze, self-draining type and meet all conditions of minimum face area and pressure drops as scheduled on the drawings.
 - 1. Coils shall have same-end supply and return connections unless vertical tube coils are used.
 - 2. Coil outer tubes shall be constructed of seamless, hard-drawn copper tubes, 1" O.D. with 0.049" minimum wall thickness. Coil inner steam distribution tubes shall be 5/8" O.D. seamless, hard-drawn copper tubes having a 0.25" minimum wall thickness.
 - 3. Coils shall have fins fabricated of 0.010" thick aluminum. Tubes to be 3" center-to-center spacing.
 - 4. Steam coils shall be one row deep with six fins per inch, unless required otherwise by application.
 - 5. Coil headers shall be of heavy gauge seamless hard drawn copper tubing with penetrations for connection of core tubing by die-formed intrusion process.
 - 6. Supply and return connections shall be of Schedule 80 extra heavy Alloy 85 red brass pipe and shall be terminated with male National Pipe Threads.
 - 7. The coil end opposite the connection end shall be free to float within the casing as expansion and contraction occurs and, as a result of this thermal movement, shall not pass through a header end sheet at any time.
 - 8. The supply header shall be encased in the return header and shall feed the inner steam distributing tubes.
 - 9. Orifice baffle plates shall be installed in the supply headers opposite the supply connection to ensure proper diffusion of the entering steam.
 - 10. Face velocity to be no greater than 600 fpm.

- B. Each coil section shall be provided with a casing constructed of continuous galvanized steel, minimum 16 gauge. Coil side plates shall be reinforced flange type and shall have $\frac{3}{8}$ " x $\frac{3}{8}$ " slots on 6" centers for mounting. Full-length fin channels shall be furnished to brace the coil core at not more than 60" centers. Coils shall be pitched towards the return header a minimum of $\frac{1}{8}$ " per foot of coil-finned length.
- C. The complete coil shall be tested under warm water to a pressure of 315 psig and guaranteed for 150 psig working pressures.
- D. After every steam trap used on steam coils shall include a test valve and then a block valve for maintenance.

2.8 FANS:

- A. Refer to Section 23 34 00 for fan requirements.

2.9 MOTORS AND DRIVES:

- A. Refer to Section 23 05 00 for motor requirements. Motors shall be mounted to be accessible and removable through the casing access door.

2.10 FILTERS:

- A. Refer to Section 23 40 00 for requirements.

2.11 FINISHES:

- A. Provide galvanized surface finish as minimum. Provide paint or special coatings as required by project conditions.

PART 3: EXECUTION

3.1 INSTALLATION:

- A. Install coils in compliance with the drawing details.
- B. Provide minimum of 36" between coils in air handling units for service.
- C. Install in conformance with manufacturer's instructions and ARI 435.

END OF SECTION 23 70 00