PHYSICAL FACILITIES
2019 Consultant’s Handbook
Division 23 HVAC
7313 Air Handling Units Over 4000 Cfm

1 Design Coordination
1.1 Coordinate carefully between the mechanical and electrical designers so as to provide electrical service to this equipment.

Note: It is a common complaint that the mechanical and electrical work on a project is poorly coordinated. An example of this is VFDs: whether it is to be specified and supplied by the mechanical but installed by the electrical or specified by the mechanical but supplied and installed by the electrical.

1.2 Dimension the unit on the drawings in both the plan and elevation views showing the required clearances and access.

Note: The goal is to show that the AHU can fit in place and is no larger than designed. The windows must be placed at eye level while standing on the floor (e.g. Nano penthouse where one has to stand on a plastic 5 gallon bucket to look in the windows).

1.3 Dimension the location of cooling coil condensate discharge and trap. This detail must show that the coil supports and base rails are tall enough to allow for the condensate trap.

Note: When this detail is missed then we have had to core drill a hole in the floor to allow the trap to be installed (e.g. Morgan Burke basement).

1.4 Dimension the location of steam entrance and steam condensate discharge (when steam coils are used), including the traps and controls valves shown to scale with necessary maintenance access.

Note: When this detail is missed we have had to install traps in front of access doors (e.g. Windsor Dining penthouse).

2 Casing construction
2.1 Drain pans

2.1.1 Drain pan sheet metal should be “double broke” to ensure complete drainage.

2.1.2 The distance the drain pans extend past the face of the cooling coil should comply with the latest edition of ASHRAE 62.1. That distance should be at least 24”.

Note: Some manufacturers have this distance so little that water is regularly carried over past the drain pan.

2.1.3 Drain pans shall be fabricated of 16 gauge 304 stainless steel.

Note: This is to ensure that the drain pan is strong enough to be walked on.

2.1.4 Drain outlet should extend to the exterior of the casing.

Note: Some manufacturers do not extend the pipe to the exterior of the unit unless specifically specified.

2.1.5 If on the side of the drain pan the pipe invert is to be mounted below the bottom of the drain pan.

2.2 Unit penetrations:

2.2.1 Penetrations such as pipe, damper rods, etc. through cabinet should be made in the factory.

Exception: The hole for the steam condensate is frequently made in the field.

Note: The goal is to minimize the number of field drilled holes in the new air handlers. Some of those holes have been excessively large and poorly cut.

3 Fans
3.1 Mounting

3.1.1 Fans to be internally mounted with factory sized deflection springs isolated on structural steel base. Fan and motor assembly shall be internally isolated from unit casing with spring isolators furnished and installed by unit manufacturer.

3.1.2 Fan shall be attached to the unit casing through a flexible duct connection.

3.1.3 AHUs with single fans shall have the fan located and dimensioned, in both the horizontal and the vertical direction, so as not restrict air flow by the walls, ceiling, or floor.

3.1.4 AHUs with multiple fan units shall have a means of preventing backflow in the event of a fan failure.

3.1.4.1 In AHUs serving areas deemed ‘critical’ this must be done in a manner that does not add ‘system effect’ static pressure to the fans.

Note: Simply adding backdraft or automatic dampers will greatly reduce the efficiency of the fan.

3.1.4.2 In AHUs serving areas not deemed ‘critical’ this may be done in a manually applied method.

3.2 Fan Bearings

Note: The fan bearings should be designed for HVAC applications and that the lubrication schedule is considered. We have had some fans delivered with a ridiculously short recommended lubrication schedule. Do not allow poly lubrication lines.
3.2.1 Bearings to be pillow block ball bearings with a rating of 200,000 hour L-10.

3.2.2 Where lubrication lines are required lubrication lines should be metal (not poly tube) and the fitting is to be within sight of the greased bearing.

3.2.3 Bearings recommend lubrication interval schedule should be listed on the submittals and shall be no more frequent than every three months.

Note: Some manufacturers use bearings as a value engineering item and have provided bearings with a required service schedule as frequently as weekly.

3.3 Fan Motors

3.3.1 Fan motors are to have a grounded shaft designed for VFD operation.

3.3.2 Fan motor bearings for direct drive fans to be HVAC grade as described earlier in this guideline.

3.4 Fan Guard and Belt Guard

3.4.1 All systems shall provide maintenance staff protection by fan and belt guards.

3.4.2 Recommended belt guard construction is using 0.1046 inch (2.7 mm) thick, 0.75 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent; prime and finish coated, and shall conform to the shape of the assembly.

3.4.3 The belts must be able to be seen through the guard with the guard in place.

3.4.4 Belt guard will have tachometer opening.

3.4.5 Belt and fan guards shall be easily removable.

Note: Though this sounds like an obvious statement many factory manufactured belt guards have proven to be difficult to both see through and remove.

3.5 Return and Relief Fans

3.5.1 Design systems using return fans avoiding relief fans to the extent possible.

Note: Fans in the relief position are significantly harder to control than fans in the return position. To a large degree this is due to the range. In the return position the RA fan range is similar to that of the SA fan minus the building exhaust. When in the relief position the fan range must vary from the minimum OA to full flow during economizer (minus building exhaust). Such a range is difficult for both the fan and the motor.

3.5.2 Mount the return fan separately from the AHU, not in the same casing.

Note: The positive static pressure at the return fan discharge is one of the highest pressures in the entire system; similarly, the negative static pressure in the mixing chamber is about the lowest. When the two fans are mounted close together the control dampers between the return fan discharge and the mixing chamber must control accurately from 0% to 100% flow against a large and unstable differential pressure. Experience has shown that this is problematic. An example of this is occurred in Armstrong in August of 2011. Human error caused both the relief and return dampers to close while the fan was running. The result can be seen in the following photographs where the fan static pressure blew the damper out of the wall.

4 Motor Removal

4.1 For motors 15 Hp and larger provide a motor removal rail.
4.1.1 The removal rail shall be mounted in fan section, directly over motor, perpendicular to the side of the AHU.

4.1.2 The removal rail will be designed with roller so the motor can be fully removed from the air handler, to a distance the motor diameter plus a minimum of 6”, and lowered onto a dolly with the traversing arm able to freely move while carrying the motor weight.

4.2 Motor and largest component must be able to be removed through the access door or an easily removable panel. For roof-top units this may be done through the back wall of the unit.

5 Coil Sections

5.1 All pipe connections, including drains and vents, shall extend beyond the exterior of the unit.

5.2 Cooling coil piping shall be factory insulated through the AHU wall. Insulation shall be sealed so no condensation can leak into the wall of the AHU.

5.3 Cooling coil headers shall be located above the drain pan.

Note: Not having the header above the drain pan has, in the past, caused condensation damage.

5.4 Stacked coil racks and guides shall be designed for the individual removal of all coils. The full weight of each coil is to be carried by the coil rack during coil removal. Stacked coils must be able to be removed individually, such that the removal of the lower coils will not affect the upper coils.

5.5 All chilled water piping internal to the AHU shall be fully primed and painted.

Note: When these pipes are only primed and not painted premature corrosion has resulted.

6 Dampers and Controls

6.1 To facilitate damper motor installation damper shafts must extend 4” minimum beyond external casing wall.

6.2 Actuators are to be attached outside the unit not installed in the air stream.

Note: Unless specifically addressed actuators can be located in the air stream causing problems when those actuators require maintenance. This has occurred even in chemical exhaust systems so the staff must ‘suit up’ just to adjust the damper motor.

7 Access Doors

7.1 Access door performance shall be comparable to the wall panels.

7.2 Access doors shall be provided for all compartments.

7.3 Latch handles shall be operable from both inside and outside.

7.4 In general, doors shall open against the air pressure. If the door cannot open against the pressure then integral safety catches must be provided.

8 Electrical

8.1 Each accessible section shall be provided with interior light, 48” vapor proof where possible. If the unit is wider than 72” then install two 48” fixtures in fan section.

8.2 Lights shall have a common 60 minute wind-up / or solid state mechanical timer light switch or other means to prevent the lights being on unnecessarily.

8.3 Each unit to have at least one GFI receptacle on the outside AHU surface.

8.4 All lights and receptacles are to be wired to a single junction box. All wiring inside the air handler is to be run through “rain tight” EMT or “seal tight” flexible conduit.

8.5 All conduit connected to the AHU is to be isolated to prevent transmission of vibration.

9 UV Lights

9.1 UV lights will be installed as directed in the program.

9.2 When UV lights are not required in the program then provision will be shown in the design and submittals for future installation.

10 Rooftop Units

10.1 In addition to the foregoing rooftop units should meet the following requirements.

10.2 Unit will have a separate sloped roof designed for a snow load of 30 psf with a deflection of no more than L/240.

10.3 Units will have a minimum 8’-0” wide service vestibule.

10.3.1 Service vestibules need to have minimum 1½” drains. Plans and submittals to show that drains have freeze protection.
**Note:** It is inevitable that water will eventually leak in the vestibule and it must be drained.

10.3.2 Service vestibules may have a removable grated floor. If the unit does not have a grated floor, provide access for all traps.

**Note:** Vestibule steam traps are typically located under the vestibule floor. Many manufacturers have not adequately thought through access to those traps.

10.3.3 Manufacturer shall supply structural steel supports for piping and other hanging equipment located in the vestibule. This must be at least 2x2x1/4 square tube risers with "H" beams 6'-0" O.C.

**Note:** Many manufacturers supply a vestibule that is not robust enough to support the interior piping, causing significant problems during construction and resulting in a vestibule with reduced free access.