

## SECTION 23 70 00 - CENTRAL HVAC EQUIPMENT

### PART 1 - GENERAL

#### 1.1 DESIGN REQUIREMENTS

##### A. General:

1. Locate roof-mounted equipment as inconspicuous as possible by placing equipment far away from edge of roof, painting, screening or a combination of these,
2. Locate fans, motors, and drives for safe and easy access for periodic inspection and maintenance.
3. Show air handling unit arrangements on schematic diagrams.
4. Scheduled fan sound ratings where noise levels are critical.
5. All fans shall be licensed to bear the AMCA Seals for Air and Sound Performance.

##### B. Fan specifications and accessories for all fans 12 inch and larger wheel shall include the following.

1. Direct drive fans are preferred.
2. Provide building air handling unit fans with external bearings only. Shafts 3/4 inches and larger shall have roller bearings. No internal bearings recessed into fan housing shall be allowed. All bearings shall be accessible for lubrication, maintenance, and replacement.
3. Aluminum wheels are not allowed except for spark proof applications.
4. Install weatherproof housing over motor and drive when exposed to weather. Metal interior casings and wheels shall be coated if fumes are corrosive.

##### C. Fan Vibration Isolation:

1. Provide spring isolators either within the air handling unit housing or independently mounted to reduce the transmission of distributing vibration of the fan to the supporting structure by a minimum of 90%.

##### D. Drives:

1. Single belt drives shall be utilized only on equipment with 1 Hp motors or less.

##### E. Air Handling Units:

1. Inlet Louver: Shall be sized with 300 fpm face velocity to slow down the snow induced into the unit. Bird screen 1/2" x 1/2" shall be utilized in such a manner that vacuuming of the screen can be done.
2. Air handling units shall be designed and installed with sufficient room to allow the installation of all control components including but not limited to preheat coil discharge air temperature averaging sensors.
3. Architect and mechanical engineer shall coordinate the space requirements for the airflow monitoring equipment per the manufacturers required straight duct length to measure airflow
4. Heat Recovery Coil: When applied, shall be a minimum 4-row coil with the face velocity not to exceed 600 fpm. Access for vacuuming on both sides.
5. Preheat Coil: Steam coils shall be vertical tube with integral face and bypass. Steam control
6. Valve shall be installed to modulate the flow of steam. All hot water preheat coils shall be pumped. Heating coils: Shall be located far enough from the heat recovery coil so that an averaging sensor can be located to measure the leaving air temperature
7. Cooling Coil: Shall be located far enough from the preheat coil so that an averaging sensor can be located to measure the leaving air temperature.
8. Air ratings are based on actual site elevation of 5200 feet.
9. Any AHU with outside air intake:
  - a. Provide low temperature detectors. The heating coil shall be located before the chilled water coil. Provide adequate space between coils for low temperature detectors. Low temperature reset should be accessible without the need for a ladder.
  - b. Provide air blender.

- c. Provide turbulators on heating coils.
- d. Provide evaporative cooling section.
  - 1) Reference 23 76 00 Evaporative Cooling for more information.
  - 2) Direct evaporative section shall be sectioned for multi-staging.
  - 3) Section shall be located far enough from the cooling coil so that an averaging sensor can be located to measure the leaving air temperature.
  - 4) Consideration given to bypass dampers for greater discharge temperature control.
  - 5) Consider high pressure fogging for vivariums and laboratories over evaporative pad based systems.
- 10. Locate air handling equipment inside buildings.
- 11. Any fan coils with outside air:
  - a. Provide low temperature detectors. The heating coil shall be located before the chilled water coil. Provide adequate space between coils for low temperature detectors.
  - b. Low temperature reset should be accessible without the need for a ladder.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Acceptable Manufacturers:

- 1. Air Handlers:
  - a. Haakon (preferred)
  - b. Energy labs
- 2. Fan Coil Units:
  - a. McQuay
  - b. International Environmental

#### B. Air Handling Units:

- 1. Panels:
  - a. Low pressure casings, less than 1-1/2 inch static pressure: Single wall construction, galvanized steel with 1-inch, 3/4-pound mat faced glass fiber insulation.
  - b. High-pressure casings, above 1-1/2 inch static pressure inch sandwich panels filled with insulation. Exterior panel sheet to be 18 gauge galvanized steel and interior panel sheets 22 gauge perforated galvanized steel.
- 2. Access Doors: Same material and finish as cabinet with hinges, latches, handles, and gaskets. Provide neoprene gaskets around full perimeter of access doors. Doors shall be 24 inches wide and 60 inches high when possible. Provide view window with safety reinforcement mounted in access door. Doors shall open against the air pressure.
- 3. Light: Marine type, vapor tight, incandescent light fixture. Each light controlled by an individual switch. Provide light in each fan section with an access door.
- 4. Fan Section:
  - a. Fan statically and dynamically balanced for continuous operation at maximum rated fan speed and motor power.
  - b. Shaft: Hot-rolled steel; turned, ground, and polished, with keyway to secure fan wheel hub. Shaft shall not pass through its first critical speed as the unit comes up to its rated rpm.
  - c. Shaft Bearings: Greasable, self-aligning, pillow block type ball or roller bearings with L50 rated bearing life of 200,000 operating hours. Factory lubricated and equipped with grease fittings extended to the motor side of fan.
- 5. Coil Module:
  - a. Insulated, 16 gauge galvanized steel casing for heating and cooling coils. Coil headers and return bends enclosed in casing. Coils accessible for service and removable through access doors or removable panels.
  - b. Coil performance certified in accordance with ARI 410.

- c. Water Coils: Drainable with threaded plugs. Serpentine with return bends or return headers. Coils tested to 300 psig air pressure under water. Coil circuited for counter flow of air and water.
  - d. Steam Coils: Pitch coils for proper drainage of steam condensate. Coils tested to 300-psig air pressure under water.
  - e. Heating Coils: Provide turbulators on heating coils.
  6. Filter Module:
    - a. Galvanized steel filter racks, access door, and block-offs to prevent air bypass around filters.
    - b. Provide minim 12” space between filter rack for installation of differential pressure gauge.
  7. Dampers: Galvanized steel blade, air foil design, Low leakage dampers rated according to AMCA 500 shall not exceed 2 percent of air quantity at 2000 fpm face velocity through damper and 4-inch wg pressure differential.
  8. Motors: Reference section 23 05 13.
  9. Spare Parts: Refer to Section 01 78 46 – Extra Stock Materials.
- C. Total Heat Recovery Wheel
1. The energy recovery wheel shall be certified to ANSI/ARI Standard 1060 and bear the ARI 1060 label. Performance characteristics of the energy wheel shall be provided as defined by ARI 1060 definitions. The energy wheel shall be a total energy wheel, with the sensible and latent effectiveness reported and within 5% of each other. The calculated total net effectiveness of the recovery wheel shall not be less than 70% when the specified ventilation flow rate equals the exhaust flow rate. The energy wheel’s entering air transfer rate (EATR) shall be less than the 3%. The amount of outside air transferred to the exhaust air shall also be reported to ensure proper fan and damper sizing. Wheel face velocity shall not exceed 900 fpm and pressure drops shall be less than 1.25” w.g.
  2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belts. The energy wheel media shall be constructed of synthetic fiber or polymer media. The media shall not be subject to corrosion in marine or coastal environments. The adsorbent shall be integrally bound into the media or impregnated into the media without the use of binders or adhesives. The adsorbent shall not be applied as a glued on surface coating and not susceptible to erosion, abrasion, or delamination. The adsorbent shall be selected for its high affinity for water vapor and shall not dissolve or deliquesce in the presence of water or high humidity. Energy recovery cassettes shall be UL-recognized components certified for mechanical, electrical and fire safety in accordance with UL Standard 1812.
  3. Energy recovery media shall be provided in the form of removable segments. The media shall be effectively captured in segment frames providing a rigid and self-supporting matrix. Segments shall be removable without the use of tools to facilitate maintenance and cleaning as required. All diameter and perimeter seals shall be provided as part of the cassette assembly. Perimeter seals shall be self-adjusting and diameter seals shall be adjustable. Seals shall be factory set.
  4. Wheel drive motor shall be provided mounted in the cassette frame. Motor locations shall be as indicated on the schedule and drawings. Wheel drive motor shall be thermally protected and UL Component Recognized. Drive belts shall not require belt tensioners. Wheel motors shall be of the voltage, phase, frequency, and Hp indicated on the schedule and drawings. Wheel bearings shall be permanently sealed and lubricated.
  5. Access doors shall be provided for the removal of wheel segments. Doors shall be located to allow access to the entire upstream and downstream face of each wheel. Adequate space and access shall be provided for energy wheel motor, bearing and belt removal.
  6. Energy recovery wheels shall be designed with variable effectiveness control, to vary the wheel’s recovery capacity. Variable effective control shall be done by an internal bypass damper provided by the AHU Manufacturer. The wheel’s variable effectiveness control shall have the ability to modulate the total energy recovery ability down to at least 40% of the initial recovery capacity.
  7. Frost prevention shall be achieved by outside air bypass. Frost set point temperatures based on the scheduled design air conditions shall be provided by the AHU Manufacturer. Winter design supply and exhaust air conditions leaving the energy wheel shall be provided by the AHU Manufacturer and shall include any de-rate in performance due to frost prevention measures.

8. All controls for unit operation shall be by Division 23 09 00.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL:

- A. Install equipment such that filters, motors, bearings, and belts can be easily serviced.
- B. Install filters prior to starting fans.
- C. Connections:
  1. Connect piping to air handling units with flexible connectors.
  2. Connect drain piping to condensate drain pans with deep trap. Route piping to nearest floor drain. Install cleanouts at changes in direction.
  3. Install flexible connections at inlet and outlet of fans connected to ductwork.
- D. Locate motor disconnect within 3 feet of the motor.
- E. Fan Drive:
  1. Align belts with proper tension prior to start-up.
  2. Final sheave shall be fixed. Balancing firm's variable sheaves will be removed and replaced with the proper sized fixed sheaves.
  3. Original sheaves shall be changed when required for proper balancing.
- F. Fans:
  1. Access shall be provided to allow cleaning of fan and blades without disassembling ductwork
  2. Install fans in accordance with manufacturer's printed data. Prior to starting fan, clean ductwork and lubricate bearings.
- G. Air Handling Units:
  1. Allow access for cleaning coils from both sides. Provide a means to catch and dispose of cleaning solutions with pipe to drain on larger coils.
  2. Provide space for removing and repairing coils and other components.

#### 3.2 TESTING, CLEANING, AND CERTIFICATION

- A. Clean fan interiors. Vacuum clean fan wheels, cabinets, and coils entering air face.
- B. Provide one (1) new set of filters to be installed by contractor at the time of system acceptance.
- C. Provide air handler schedule listing for each unit, location, filter sizes, coil sizes, motor Hp, belt size, and areas served.

#### 3.3 COMMISSIONING (DEMONSTRATION)

- A. Provide 2 hours of operating instructions for each fan and air handling unit. Include procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Review data in the operation and maintenance manuals.

**END OF SECTION 23 70 00**