



SECTION 23 74 13 - CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular factory fabricated air-handling units and accessories for indoor and outdoor installation.

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 3. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 4. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 - 5. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- C. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
 - 2. ARI 430 - Central-Station Air-Handling Units.
 - 3. ARI Guideline D - Application and Installation of Central Station Air-Handling Units.
- D. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- E. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- F. Underwriters Laboratories Inc.:
 - 1. UL 900 - Air Filter Units.
 - 2. UL - Fire Resistance Directory.
- G. NRCA standards.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.



B. Product Data, Submit the following:

1. Published Literature: Indicate capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Dampers: Include leakage, pressure drop, and sample calibration curves. Indicate materials, construction, dimensions, and installation details.
6. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring. Indicate factory installed and field installed wiring.
7. Clearly identify the type of Coating(s) being proposed for use.

C. Manufacturer's Installation Instructions

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.5 QUALITY ASSURANCE

- A. All items shall be in accordance with the requirements dictated by the City of Los Angeles Department of Building and Safety, and LAWA standards.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for Central Station Air Handling Units and drives.
- B. Parts warranty to be provided by manufacturer and labor warranty to be provided by the installing contractor.
- C. The Air Handling Unit manufacturer shall provide single source responsibility for all components of the unit whether specifically manufactured or purchased outside.
- D. All major components used to assemble the air handling unit, with the exception of electrical devices, control dampers, VFD drives, bearings, and controls, shall be manufactured by the unit supplier. Primary fans and coils not manufactured by the air handling unit manufacturer as a single source responsibility are not acceptable.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. Manufacturers:

1. **Temtrol.**
2. **Energy Labs.**



- B. Performance Base: Sea level.
- C. Roof Curbs: Required.
 - 1. Factory assembled galvanized steel mounting curb designed and manufactured by unit manufacturer is required for all rooftop installations.
 - 2. Perimeter type with support of air handling sections.
 - 3. Furnish supply and return opening duct frames as part of curb structure allowing duct connections to be made directly to curb.
 - 4. Minimum of 12 inches high.
 - 5. Furnish gaskets for field mounting.
- D. Interior Curb: Required
 - 1. Minimum 4 inch high concrete housekeeping pad is required for interior installations.

2.2 CASING

- A. Channel base of welded steel. Assemble sections with gaskets and bolts.
- B. Outside Casing:
 - 1. Galvanized Steel: 0.0635 inch (16 gauge).
 - 2. Seal fixed joints with flexible weather tight sealer. Seal removable joints with closed-cell foam gasket.
 - 3. Furnish cap strips over roof flanges. Furnish rain caps and gaskets on access doors.
- C. Outside Casing Finish:
 - 1. Exterior panels with 6 mils dry of self-priming semi-gloss high solids polyurethane paint over 2 mils of the epoxy primer and seal and 2 mils of the etching primer for a total of 10 mils. Coating shall withstand 5,000 hour of salt spray test in accordance with ASTM B117.
 - 2. Color: As selected by LAWA.
- D. Inside Casing:
 - 1. 316 Stainless Steel: Perforated 0.0375 inch thick (20 gauge) at fan section.
 - 2. 316 Stainless Steel: Solid, 0.0375 inch thick (20 gauge) at filter and coil section.
- E. Floor Plate:
 - 1. 316 Stainless Steel: continuously welded 0.0785 inch thick (14 gauge) at inner floor.
 - 2. Galvanized Steel: 0.0396 inch thick (20 gauge) at bottom floor.
- F. Insulation: Neoprene coated, glass fiber, applied to internal surfaces with adhesive and weld pins with exposed edges of insulation coated with adhesive.
 - 1. 'K' factor at 75 degrees F: Maximum 0.26 Btuh inch/ sq ft/ degrees F.
 - 2. Density: 4 inch thick, 3lbs/cu ft.



- G. Inspection Doors: 8 x 12 inch of galvanized steel for flush mounting, with gasket, latch, and handle assembly and 1/4 inch thick Plexiglas inspection window.
- H. Walk-in Access Doors: 24 x 60 inch galvanized steel exterior and 316 stainless steel interior insulated sandwich construction, for flush mounting, with hinges, gasket, latch, and handle assemblies, and 8 x 12 inch inspection window with 1/4 inch thick Plexiglas.
- I. Lights: Located in accessible sections suitable for damp locations with wire guards, factory wired to weatherproof switch and pilot light and duplex outlet mounted on casing exterior.
- J. Drain Pans: Double thickness 316 stainless steel with insulation between layers with welded corners. Cross break and pitch to drain connection. Furnish drain pans under mixing section cooling coil section. For units with multiple coils, provide drain pans for each coil section.
- K. Bottom Inlet Units: Furnish stainless steel walking grate on structural supports.
- L. Strength: Furnish structure to brace casings for suction pressure of 1/240 of longest plane being measured at design static pressure or a maximum of 10 in. WG.
- M. Louvers: Stationary, of galvanized steel, 4 inch deep with plenum, nylon bearings, 1/2 inch mesh, 0.04 inch galvanized wire bird screen in aluminum frame, and tested and rated per AMCA 500.

2.3 FANS

- A. Type: Plenum fan.
- B. Performance Ratings: Conform to AMCA 210 and label with AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.
- D. Mounting: Fan and motor shall be mounted on an internal, fully welded, rigid steel assembly. Each individual fan assembly shall be free-floating at all four corners on minimum 2" deflection spring type isolators with earthquake restraints. The spring isolators shall be mounted to structural steel members and shall be rated for a minimum of 1.0g, unless the Structural Engineer of Record of the building provides a higher rating. The fan discharge shall be isolated from the cabinet by means of a neoprene-coated flexible connection.
- E. Fan Modulation: Variable Frequency Drive. See Section 23 81 07 VARIABLE FREQUENCY DRIVES.
- F. Flexible Connection: Separate unit from connecting ductwork.

2.4 BEARINGS AND DRIVES (DIRECT DRIVE FANS)

- A. Single or multiple, Arrangement #4 plenum fan assemblies shall be provided. Fans shall be arranged to provide even air distribution within the unit cabinet. Minimum/maximum fan quantity shall be as indicated in the project Schedule. Total fan BHP and motor HP shall not be exceeded. Scheduled motor efficiencies are considered to be the minimum allowed.



- B. Bearings: Pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-50 life at 100,000 hours or roller bearings, or ABMA 11, L-50 life at 400,000 hours.
- C. Individual fan performance shall be based on tests run in an AMCA certified laboratory and administered in accordance with AMCA Standards 210 and 300. Fans shall be licensed to bear the AMCA seal for air and sound performance. Submitted fan performance shall be adjusted to reflect multiple fans running inside the cabinet and to reflect any affects from the unit cabinet and other internal components. Fans shall be minimum Class 2 construction.
- D. The fan wheel shall be aluminum with extruded aluminum airfoil blades continuously welded to the fan side plates. The fan back plane shall be bolted to a cast aluminum fan hub with keyway. Fans not using airfoil blades, or using steel construction, will not be considered. Fan inlets shall be isolated from the cabinet by means of a neoprene-coated flexible connection.
- E. Motors shall be premium efficiency to meet or exceed the requirements in EISA 2007. Motors shall be TEFC, NEMA frame, cast iron casing, ball bearing type complete with grease lubricated bearings and zerk fittings for field lubrication. Motors shall have a NEMA Class F insulation rating with Class B temperature rise, and have a 1.15 service factor. BHP values as shown on the Schedule are considered the maximum allowable.
- F. Fans shall be provided with thrust restraints.
- G. Each motor shall be provided with a shaft grounding device that will bleed potential induced motor shaft voltage to ground.
- H. For the safety of service personnel, provide inlet screens.

2.5 COILS

- A. Casing with access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.
- B. Drain Pans: Sized per ARI guidelines and as shown in the plan drawings downstream of coil and downspouts for cooling coil banks more than one coil high. All drain pans shall be 316 stainless steel.
- C. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.
- D. Fabrication:
 - 1. Water Coils Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
 - 2. Refrigerant Coils Tubes: 3/8 inch OD seamless copper expanded into fins, brazed joints.
 - 3. Fins: 0.008" Copper.
 - 4. Casing: Die formed channel frame of 316 stainless steel.
 - 5. All coils shall be coated with minimum 1.0 mil. aluminum impregnated polyurethane coating by Blygold PoluAl XT or approved equal. Coating shall meet or exceed a class 5B result on a Cross Hatch Adhesion Test (ASTM D3359). Coating shall withstand 4,000



hours in both salt spray test per ASTM B117 and acid salt spray (ASTM G85) test.

Finned-tube coils applied coating shall have 5 year warranty.

6. Provide five (5) year warranty for all coils.

E. Water Cooling and Heating Coils:

1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

F. Refrigerant Coils:

1. Headers: Seamless copper tubes with silver brazed joints.
2. Liquid Distributors: Brass or copper Venturi distributor with seamless copper distributor tubes.
3. Configuration: Down feed with bottom suction.

2.6 FILTRATION SYSTEMS

- A. Various filter types are specified in HVAC AIR CLEANING DEVICES, Section 23 40 00.
- B. Ultra Violet Germicidal Irradiation (UVGI) system, Section 23 42 00.
- C. Photocatalytic Oxidation (PCO) system, Section 23 41 00.

2.7 DAMPERS

- A. Mixing Boxes: Section with factory mounted outside and return air dampers of ultra-low leak extruded 6063T5 aluminum airfoil blades with dual durometer bulb type edge seals and stainless steel arc end seals in galvanized frame, with galvanized steel axles in self-lubricating nylon bearings, in opposed blade arrangement
- B. Outside Air Damper Leakage: Shall not exceed 6 CFM/ft² at 5.0" of static pressure. Leakage rating shall be determined by testing performed in accordance with AMCA Standard 500, figure 5.5, and tests shall have been performed by an independent testing laboratory.
- C. Damper Leakage: Shall not exceed 6 CFM/ft² at 5.0" of static pressure. Leakage rating shall be determined by testing performed in accordance with AMCA Standard 500, figure 5.5, and tests shall have been performed by an independent testing laboratory.
- D. Damper Actuators: Furnish factory installed electric damper actuators for outside air, return air and exhaust air dampers.

2.8 OUTSIDE AIR MEASURING AND MODULATION DEVICE

- A. Factory mounted thermal dispersion type Airflow Measurement Device (AMD) for the outside air, return air and supply air.
- B. Damper and airflow measurement assembly sized to accommodate economizer outside airflow.



C. Performance Data:

1. Each sensing node shall have an airflow accuracy of $\pm 2\%$ of reading over an operating range of 0 to 5,000 FPM (25.4 m/s).
 - a. Accuracy shall include the combined uncertainty of the sensor nodes and transmitter.
 - 1) Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with this requirement over the entire operating range.
2. Each sensing node shall have a temperature accuracy of $\pm 0.15^\circ \text{F}$ (0.1°C) over an operating range of -20°F to 160°F . (-28.9°C to 71°C).

2.9 CONTROLS

- A. All Central Station Air Handling Units shall be equipped with the unit controller capable to be integrated into the Building Automation System (BAS). Refer to Section 25 20 00 of the Guide Specification.
- B. Factory mount controls conduit and junction boxes in each section for field mounting of control devices.
- C. Control devices provided and installed by the controls contractor in the field.

2.10 ELECTRICAL

- A. Motor:
 1. Inverter duty, NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 2. Enclosure Type: Totally enclosed, fan cooled.
 3. Motors must be "matched" with variable frequency drives.
 4. Provide shaft grounding device that will bleed potential induced motor shaft voltage to ground.
- B. Electrical Requirements
 1. Where unit-mounted disconnects are provided, mount unit-mounted disconnect switches on exterior of unit.
 2. Variable Frequency Controllers shall be factory mounted in a ventilated compartment which is part of the air handling unit and factory wired to motors and controls. Access shall be through a louvered access door.

2.11 FACTORY TESTING

- A. The following testing shall be provided on a minimum of three units. LAWA shall select the three units to be tested. **Manufacturer shall include cost of travel to allow two LAWA representatives to witness all factory tests.** Manufacturer shall provide a written report of all test results to the Contractor and LAWA as part of the shop drawing process. In the event that tested units do not meet performance requirements (Including but limited to leak, deflections, air volume and sound), manufacturer shall provide enhancements, within the requirements of this specification, until unit meets testing requirements. In the event that two



or more units do not meet performance requirements, LAWA shall select an additional three units for testing – and the above requirements shall be applicable to newly tested units.

B. Factory Leak Test

1. Factory test shall verify that unit casing leakage is less than 0.5% of design airflow or 100 CFM whichever is greater at 1 ½ times design static pressure or a maximum of 10 in. WG. Unit openings shall be sealed. A pressure blower shall be connected to the air-handling unit and adjusted to provide the test pressure. At the manufacturer's option, the unit shall be either positively or negatively pressurized. CFM shall be measured using a calibrated orifice. The measured CFM shall be considered casing leakage. Casing leakage must not exceed 0.5% of design CFM.

C. Factory Cabinet Deflection Test:

1. Air handling unit manufacturer shall provide Panel Deflection Test on units in conjunction with the Casing Leakage Test. Panel deflection test shall verify casing deflection is less than 1/240 of longest plane being measured at design static pressure or a maximum of 10 in. WG. The casing deflection shall be measured at midpoint of panel and at panel seam.

D. Factory Air Performance Test:

1. Air handling unit manufacturer shall test at an AMCA Accredited Laboratory for air performance per AMCA Standard 210-99. For air handling units with air volumes below 65000 CFM, air volume shall be determined using a multiple nozzle chamber that meets the requirements of AMCA 210-99 (Laboratory Methods for Performance Testing) figure 12 or 15. Measured air volume, static pressure, and RPM shall be within the tolerance limits of AMCA Standard 211 (Certified Ratings Program Air Performance).

E. Factory Sound & Air Performance Test:

1. Air handling unit manufacturer shall test a minimum of three units at an AMCA Accredited Laboratory for airflow testing in accordance with AMCA Standard 210-99 and sound testing in accordance with AMCA Standard 300-96. Specified air volume shall first be confirmed in accordance with AMCA standard 210-99 (Laboratory Methods of Testing Fans for Performance Rating). Air Volume, static pressure, and RPM shall be within the tolerance limits of AMCA Standard 211 (Certified Ratings Program Air Performance).
2. Once design operating point has been confirmed, the submitted sound power levels for both inlet and outlet shall be measured per AMCA Standard 300-96 (Reverberant Room Method for Testing of Fans) and the relevant parts of ARI Standard 260-01 (Sound Rating of Ducted Air Moving and Conditioning Equipment). The total air handling unit volume shall not exceed 5% of the volume of the reverberant room. The reverberant room used for testing shall be qualified to perform narrow band measurements in accordance with AMCA Standard 300-96 Appendix B. All measurements shall be taken in 1/3 octave bands. If applicable, duct end correction and elbow corrections shall be calculated per ARI Standard 260-01. The test results will verify that inlet and outlet sound power levels are within the tolerance limits of AMCA-311 (Certified Sound Ratings Program) of the specified levels.



3. Sound power data shall be given at the supply connection(s) and return connection(s) in addition to radiated sound power from the cabinet. Raw fan sound power data shall be derived from tests done on the same sizes and types of fans scheduled. Data extrapolated from non-like fan sizes and types scheduled, is not acceptable. Attenuation assumed for cabinet configuration, type of insulation, opening locations, and sizes, etc., shall be verified through actual test measurements.
4. Alternate equivalent method of testing will not be accepted.
5. Factory testing not required for knock-down construction air handling units.
6. Contractor is responsible for the field testing of the knock-down construction air handling units.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible connections between AHU discharge and ductwork.
- B. Install condensate piping with trap and route from drain pan to nearest code approved receptacle via gravity flow and terminate with an air gap as required by Code.
- C. Insulate exposed section of the coils as specified for piping.

3.2 INSTALLATION CHILLED WATER COOLING COIL

- A. Make connections to coils with unions or flanges.
- B. Connect water supply to leaving airside of coil (counter flow arrangement).
- C. Locate water supply at bottom of supply header and return water connection at top.
- D. Install water coils to allow draining and install drain connection at low points.
- E. Install the following piping accessories on chilled water piping connections.
 1. On supply:
 - a. Thermometer well and thermometer.
 - b. Well for control system temperature sensor.
 - c. Shutoff valve.
 - d. Strainer.
 - e. Control valve.
 - f. Pressure gage.
 2. On return:
 - a. Thermometer well and thermometer.
 - b. Well for control system temperature sensor.
 - c. Pressure gage.
 - d. Shutoff valve.
 - e. Balancing valve or Flow control valve.



3.3 INSTALLATION HOT WATER HEATING COIL

- A. Same as for chilled water coil.

3.4 TRAINING

- A. Furnish services of factory trained representative for minimum of one day to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct LAWA on operation and maintenance. Training to include minimum of 8 LAWA personnel for 40 hours training, 16 hours shall be classroom training per person and 24 hours shall be hands-on training per person.

3.5 CLEANING

- A. Vacuum clean coils and inside of unit cabinet.
- B. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

3.6 PROTECTION OF FINISHED WORK

- A. Do not operate units until units and ductwork are clean, filters are in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 23 74 13