UNIVERSITY OF MICHIGAN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION

ARCHITECTURE & ENGINEERING
326 East Hoover, Mail Stop B
Ann Arbor, MI 48109-1002
Phone: 734-764-3414
Fax: 734-936-3334

BuildingName
The Description of the Project
P00000000 0000

SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23
SECTION 238219 - FLOOR MOUNTED FAN COIL UNITS (UN-DUCTED)

END OF CONTENTS TABLE

DIVISION 23
SECTION 238219 - FLOOR MOUNTED FAN COIL UNITS (UN-DUCTED)

REVISIONS:

FIRST EDITION MAY 2010, AEC MECH TECH TEAMS - HVAC/CONTROLS GROUP. DEVELOPED BASED ON THE NORTH QUAD RESIDENCE HALL FAN COIL SPECIFICATION. GENERALLY INTENDED FOR SMALL (< 1/2 HP) VERTICAL FAN COILS MOUNTED INSIDE THE ROOM WITH CHW AMD HEATING COILS. COULD BE ADAPTED FOR OTHER TYPE IN-ROOM FAN COILS.

FAN COIL ROOM CONTROLLER (I.E. THERMOSTAT) AND CONTROL VALVES ARE SPECIFIED IN SECTION 230900 MECHANICAL SYSTEMS CONTROLS, AND NOT IN THIS SECTION. THIS SECTION COVERS ONLY THE FAN COIL CONTROL TRANSFORMER AND RELAY PACK.

NEW FORMAT DRAFT NOVEMBER 15, 2010. MANUFACTURERS UPDATED, FORMAT AND ORGANIZATION REVISED.

OCT 2015: ADDED PRICE AS APPROVED MFR. D. KARLE PER HVAC MTT.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

CAREFULLY VERIFY, EDIT AND COORDINATE RELATED SECTIONS.

B. Related Work Specified Elsewhere: Examine Drawings and other sections of the Specifications for requirements that affect and specify work under this section, in particular the following:

1. Section 221113: Piping Materials and Methods.
2. Section 220523: Valves.
3. Section 220513: Motors.
4. Section 220719: Mechanical Systems Insulation.
5. Section 232116: Hydronic Piping Specialties.
6. Section 230900: Mechanical Systems Controls.
7. Division 26: Electrical.

1.2 SUMMARY

A. Section Includes

1. Floor-mounted fan-coil units, with controls provided in part or in entirety by the fan coil manufacturer, as specified.

REVISE THE ALTERNATES REQUIREMENTS AND THE CORRESPONDING INFORMATION IN PART 1 AND PART 2 BASED ON PROJECT REQUIREMENTS.

IF THERE ARE NO BID ALTERNATES, INDICATE "NONE." CONSIDER SPECIFYING ECM MOTORS AS AN ALTERNATE. CONSIDER SPECIFYING WELDED, RADIUSED CORNERS ON FRONT AND SIDE EDGES OF TOP AS AN ALTERNATE. WELDED EDGES RESULT IN A MUCH MORE ATTRACTIVE AND DURABLE CABINET AND ARE PREFERRED BY U-M HOUSING.

1.3 ALTERNATES

A. Bid Alternate No. 1: Furnish fan-coil units with pre-assembled hydronic piping package. Tubing, valves, fittings, instrumentation, supports and insulation as specified herein and as indicated on the Drawings.

1. Piping package shall be shipped from the manufacturer's factory connected to coil(s), secured and protected from damage during shipment.
2. Piping package shall include the required control valves. Control valves shall be as specified in Section "Mechanical Systems Controls."

1.4 COORDINATION

A. Coordinate dimensions and arrangement of fan coils with building elements including windowsill height, floor finish, pipe entry location, and wall construction.

REVISE SUBMITTALS AS REQUIRED. SAMPLE PARAGRAPHS UNDER 1.5 REQUIRE DELIVERY OF A SAMPLE FAN COIL WITH THE BID, AND IS WRITTEN ASSUMING THE FAN COILS WILL BE PREPURCHASED, AND THAT A PREPIPED FAN COIL WILL BE CONSIDERED AS AN ALTERNATE. SAMPLE UNIT SUBMITTAL IS HIGHLY RECOMMENDED FOR PROJECTS WITH A LARGE QUANTITY OF FAN COILS.

1.5 SUBMITTALS

A. Submit the following product data for approval:

1. Heating and cooling coil total and sensible heat transfer capacity, entering and leaving water temperatures, water flow rate, water pressure drop, and air pressure drop.
2. Details of equipment assemblies indicating dimensions, weights, required clearances, component locations, and location and size of each field connection. Include cabinet construction details: panel gauge, removal method for access panel, cabinet mounting method, and filter and fan motor removal method.
3. Details of motor including type, manufacturer and electrical characteristics.
4. Wiring Diagrams: Power, disconnect switch, controls, transformer and three-speed fan control relays.
5. Control transformer-sizing calculations.
6. Detailed information on fan control relay board.
7. Octave band and A-weighted sound power data for each unit type at fan coil rated capacity, tested per AHRI Standard 350.
8. Evidence of UL or ETL listing and labeling.

B. Equipment schedule with the following information for each unit type:

1. Quantity of each type.
2. Equipment tag.
3. Model number.
4. Manufacturer's size designation.
5. Configuration (2-pipe or 4-pipe).
6. Number of coils, number of rows for each coil, fin spacing for each coil, airflow rate and motor watts at each fan speed.

C. Maintenance schedules and repair part numbers and manufacturer of motors, coils, integral controls, relay board, control transformer, and air filters.

D. Warranty Documentation: Submit warranty documentation according to requirements of Contract Documents.

E. Detailed schedule with each fan coil tagged by room number, indicating unit style, heating and cooling capacity, left- or right-hand piping configuration, and 2-way or 3-way control valves.

THE FOLLOWING PARAGRAPHS SPECIFY CONDITIONS WHEN THE FAN COILS ARE PREPURCHASED, AND THAT A PREPIPED FAN COIL WILL BE CONSIDERED AS AN ALTERNATE. REQUIRE THAT A SAMPLE FAN COIL UNIT BE DELIVERED WITH THE BID AND IS WRITTEN ASSUMING. SAMPLE UNIT IS HIGHLY RECOMMENDED FOR PROJECTS WITH LARGE QUANTITIES OF FAN COILS.

F. Samples: Submit sample fan coil unit with bid: One unit, Type FCU-XX, pre-piped, with factory-applied color finish, and factory-installed piping package:

1. Sample unit shall comply with these specifications in all respects.
2. Configure piping for 2-way control valves with 3/4 inch nominal control valve body size.
3. Provide Sample unit pre-piped with piping accessories and control valves, arranged per the drawing details. See "Factory-Provided and Installed Hydronic Piping Package" in Part 2.
4. Piping shall be 3/4 inch nominal size. Pipe unit for 4-pipe configuration.
5. Configure sample unit to allow the fan to operate at all three speeds after temporary power is provided.

1.6 DELIVERY, STORAGE AND HANDLING

A. Mark each fan coil cabinet back with the scheduled room location.

B. Mark the fan coil room locations on the outside of the shipping box.

C. Support piping to prevent damage to pipe and coil headers during shipping.

D. Restrain fans and other components to prevent damage during shipping.

E. Ship each unit wrapped in a heavy plastic bag, packed in a corrugated cardboard shipping box.

REVISE MAINTENANCE MATERIAL SUBMITTALS TO SUIT PROJECT REQUIREMENTS. FILTERS AND TOUCH-UP PAINT ARE GENERALLY NOT REQUIRED FOR SMALL PROJECTS. REVIEW PART 3 REGARDING TEMPORARY USE OF FAN COILS DURING CONSTRUCTION AND FINAL FAN COIL TURN-OVER TO OWNER AND THE REQUIREMENTS FOR EXTRA FILTERS. REVISE

TOOLS IN PARA. D BASED ON THE QTY. OF FAN COILS. CONSIDER LISTING OTHER SPARE PARTS THAT MIGHT BE UNIQUE TO THE FAN COIL.

1.7 EXTRA STOCK MATERIALS

A. Furnish extra materials described below that match installed products. Package with protective covering for storage. Affix labels describing contents.

B. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Coil-Unit Filters: Furnish start-up filter (installed in the shipped unit) and one spare filter for each filter installed.
2. Touch-up paint: 48 fluid ounces total for each cabinet color, in spray cans.
3. Tool or bit to remove the tamper-proof fasteners: total quantity of twenty.

C. Extra materials, excluding start-up filters, are for the Owner's use, not for Contractor's use, during construction.

D. Provide units built, tested, and installed in compliance with the latest edition of the following quality assurance standards, unless noted otherwise:

1. ANSI/AHRI 350 Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment.
2. ANSI/AHRI Standard 440: Performance Rating of Room Fan-Coils.
3. NFPA 70- National Electric Code.
4. NFPA 90A Installation of Air-Conditioning and Ventilating Systems.
5. ANSI/ASHRAE 62.1 Section 5 (Systems and Equipment) and Section 7 (Construction and Start-up).
6. ANSI/ASHRAE 90.1-2007 Energy Standards for Low Rise Buildings Except Low Rise Residential Buildings.
7. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.
8. ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
9. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
10. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
11. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
12. Fan coils shall be Underwriters Laboratories (UL) or Intertek (ETL) listed.

REVISE WARRANTY PER PROJECT. TWO-YEAR WARRANTY MAY BE APPROPRIATE WHEN PURCHASING LARGE QUANTITIES OF FAN COILS.

E. Promptly remedy any Work not in accordance with the Contract Documents, within a one-year period from the date of Substantial Completion, according to the Standard General Conditions and Supplemental General Conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with all requirements, provide products from one of the following manufacturers:

1. Airtherm, Westfield, MA.
2. Enviro-Tec by Johnson Controls, Largo, FL.
3. International Environmental Corporation, Oklahoma City, OK.
4. Price Industries

VERIFY THE REQUIRED PROJECT SPECIFIC DIMENSIONS FOR THE FAN COILS AND SCHEDULE OR SPECIFY ACCORDINGLY. MANUFACTURER'S STANDARD HEIGHT UNITS MAY NOT FIT PROPERLY UNDER EXISTING WINDOWS/WINDOW SILLS.

LIST FAN COIL SOUND POWER LEVELS IN THE FAN COIL SCHEDULE OR IN THE SPECIFICATIONS. BE PARTICULARLY CAUTIOUS FOR FAN COILS USED IN SLEEPING QUARTERS.

2.2 MANUFACTURED FAN COIL UNITS

A. Factory fabricated Fan Coil Units: Built, tested, and rated in accordance with the Quality Assurance Standards referenced in this Section.

1. Mark the room location on the fan coil cabinet back.

B. Capacities: As indicated in the equipment schedules.

C. Dimensions: Maximum allowable dimensions as indicated on the Drawings. Maximum allowable height shall include the height of the leveling legs when adjusted to their minimum extension position.

2.3 FAN COIL UNIT CONSTRUCTION

A. Chassis:

1. Construction: Heavy gauge, minimum G60 galvanized or A40 galvannealed steel. Construct to eliminate racking.
2. Provide a minimum of four leveling legs with minimum 1-inch adjustment.
3. Provide framing members with a minimum of two 7/16 inch diameter minimum, wall-mounting holes and two floor-mounting holes. Provide additional holes if required for safe and secure mounting. Mounting holes to permit bolting to the wall and the floor with lag screws.

B. Cabinet: Steel with baked-enamel or powder coat finish.

1. Tops: Steel, 18 gauge minimum thickness.
2. Front and sides of cabinet: Steel, 16 gauge minimum thickness.

NOTE THAT THE PARAGRAPH BELOW IS FOR AN EXTERNAL (REMOTE) THERMOSTAT FOR THE FAN COIL. REVISE WHEN THE PROJECT REQUIRES A FAN COIL WITH DOORS TO ACCESS A FAN SPEED SWITCH OR THERMOSTAT CONTROL.

3. Cabinet tops: Sloped, seamless and continuous without access doors for temperature controls, fan speed switches, and other controls.
4. Outlet grille: Pencil-proof and stamped into the top with all grille edges recessed into the casing and not projecting out of the casing.
5. Cabinets and front panels shall have all edges turned over and all burrs removed. The finished product shall have no sharp edges.
6. Front panel: Removable, with channel-formed edges and insulation on the entire interior face of the panel, and secured with tamper-resistant cam fasteners. Fasteners designed with a hexagonal socket for use with a common hex-head tool (allen wrench) shall not be acceptable.
7. Extend the front access panel for the full width of the fan coil cabinet, included the piping pocket extension and electrical pocket.
8. Provide an extension on the piping side of the cabinet unit. Extension shall result in an overall inside width of the piping pocket of not less than 17 inches. Extension shall be continuous with the front, top, sides, and bottom of the cabinet and shall not have an "add-on" configuration. Provide a cutout in the cabinet end to allow connecting piping to be routed into the piping pocket.
9. Provide an electrical equipment pocket, on the side opposite of the piping pocket, with a minimum clear inside width of 8 inches.
10. Base or legs: Form all vertical surfaces of solid sheet metal, including sides facing the air stream (facing the return air/air filter opening); open construction is not permissible.
11. Apply insulation in the entire cabinet on the interior faces including the end pockets, sides, front, and top panel away from the coil section. Apply insulation to interior cabinet surfaces to insulate the conditioned air stream and to prevent sweating. Do not insulate chilled water/dual temperature piping inside the cabinet. Secure Insulation to cabinet with water-based, non-out-gassing adhesive providing 100 percent coverage of the cabinet interior surfaces.

C. Finished Surfaces: Clean, phosphatize, and coat with a factory baked-on or powder-coat primer, and separately applied baked or powder coated finish paint. Final color shall be as selected from the manufacturer's standard color palette.

D. Insulation: Coil and Cabinet: minimum 1/2-inch-thick closed-cell elastomeric foam complying with the following:

1. ASTM C 411 Standard Test.
2. Attach with adhesive complying with ASTM C 916.
3. Fire-Hazard classification, insulation and adhesive combined: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

E. Drain Pans: Fabricate drain pans and drain connections to comply with ASHRAE 62.1.

1. Main drain pan (pan immediately below coil): Stainless steel, insulated.
2. Auxiliary drain pan: Insulated molded plastic or stainless steel with threaded drain connection. Pan shall receive condensate from main drain pan. Provide large enough to capture condensate dripping from all chilled water and dual temperature piping located inside the fan coil cabinet.
   a. Note: Do not insulate chilled water/dual temperature piping inside the cabinet.

F. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2

1. Disposable Type 1 inch pleated cotton-polyester media: 90 percent arrestance and 7 MERV.
2. Replaceable through return air opening without removing access panel.

2.4 HYDRONIC COILS

A. Hydronic Coils: Copper tube, minimum 0.025 inch wall thickness, with mechanically bonded aluminum fins, maximum of 12 fins per inch, copper headers and copper connections; rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 degrees F.

1. Factory test all coils as specified in the Source Quality Control article.
2. Include manual air vent and drain connections accessible from the pipe access chase end of unit.
3. Chilled water and dual-temperature water coil casings, tracks, baffles, and supports shall be of stainless steel construction.
4. Provide coil piping connections extended into the piping pocket.

2.5 FAN AND MOTOR BOARD ASSEMBLY (BLOWER DECK):

A. Fan(s) and motor(s): Mount on a common, rigid, sheet metal panel, fully insulated and removable as an assembly for ease of maintenance. Assembly shall be removable and replaceable through the front access panel and shall not require the removal of side panels.

B. Fan: Forward curved, double width, centrifugal; directly connected to motor. Galvanized steel or aluminum wheels; galvanized-steel fan scrolls.

C. Motor: Three speed, single phase, permanent split capacitor (PSC) type with permanently lubricated bearings. Provide motor with resilient mounting and built-in overload protection with automatic reset.

D. Wiring termination: Pre-wire motor to power/relay board with quick-disconnect plug connection.

E. The maximum allowable fan and motor RMS velocity at the maximum fan speed shall not exceed 0.15 in. /sec. in the horizontal, vertical and axial directions. Fans may be field tested after installation by an independent third party. The manufacturer, without cost to the Owner, shall correct any fan/motor found to exceed these vibration limits.

NOTE THAT THE FOLLOWING ARTICLE IS WRITTEN FOR AN EXTERNAL (REMOTE) THERMOSTAT (ROOM CONTROLLER) USED FOR THE FAN COIL, SUPPLIED BY THE CONTROLS CONTRACTOR. EDIT AS REQUIRED IF PROJECT REQUIRES DIFFERENT CONTROLS,

2.6 FAN COIL CONTROLS AND ELECTRICAL CONNECTIONS

A. Control devices and operational sequences are specified in Section "Mechanical System Control" and the Sequence of Operation indicated on the control drawings. Provide pre-wired controls that achieve the operational sequences and that are compatible with the remote thermostat (room controller) specified in Related Section "Mechanical Systems Control." Remote thermostat will be provided and wired to the fan coil by the controls contractor.

B. Provide a three-speed fan relay control board pre-wired to the fan, and with connections for the low voltage remote thermostat. Coordinate with controls contractor and assure control relay board is compatible with remote thermostat. Relays shall be silent in operation.

C. Provide 120/24 volt control transformer inside a separate protective cover, or with fully guarded wiring connections. Control transformer shall be a discrete device, not part of a circuit or relay board. Size transformer for control valve(s), thermostat, and fan relays, plus 20 percent of maximum load. Transformer shall be appropriately fused on both the line side and the load side.

D. Mount all electrical devices secured to the chassis inside the chassis pocket opposite the piping pocket.

E. Completely factory pre-wire disconnect switch, motor(s), control transformer, and relay board. Isolate all high voltage (120V) wiring from low voltage (24V) wiring via separate junction boxes and wireways.

1. Provide 120V disconnect switch mounted on a junction box adequately sized to allow external "single point" high voltage power connection to the fan coil unit. Configure disconnect wiring to turn off all high and low voltage power in the fan coil.
2. Provide a thermostat junction box to allow "single point" connection of thermostat wiring. Terminate control valve (when control valves provided by fan coil manufacturer), control transformer, and relay board wiring in the thermostat junction box. Provide a junction box of adequate size to allow controls contractor to terminate all thermostat connections, and control valve wiring when control valves are not provided by fan coil manufacturer, inside the box with wire nuts.

F. Provide a project specific wiring diagram affixed to the inside of each fan coil cabinet.

G. All electrical work shall comply with applicable Related Documents, Electrical Sections and Quality Assurance Standards.

2.7 FAN COIL UNIT WITH HYDRONIC PIPING PACKAGE - BASE BID AND ALTERNATE WORK

REVISE BELOW DEPENDING ON PROJECT REQUIREMENTS. FILL IN BID ALTERNATE NUMBER IN PARAGRAPH B OR EDIT, AS APPLICABLE:

A. Base Bid Work: Factory-Provided and Installed Hydronic Piping Package is not provided.

1. Provide coil piping connections protected with plastic end caps, ready for field connection.
2. Provide threaded brass plugs in coil header air vent and drain connections.

B. Alternate Work: Complete pre-assembled hydronic piping package under Bid Alternate No. **X.**

1. Configure piping as indicated in the piping details.
2. Tubing: Seamless copper tubing, Type L, soldered joints.
3. Provide piping components including piping, valves, fittings, joints, instrumentation, as specified in Related Specification Sections. Do not provide components or products from component manufacturers that are not specified and listed in the Contract Documents.
4. Include control valves as described in Related Specification Section. Valves shall be of pipe size and 2-way or 3-way configuration as indicated for specific fan coils. Engineer shall select Control valve Cv during submittal process. At the discretion of the Engineer, smaller valve body size may be selected at that time.
5. Do not insulate chilled water and dual temperature piping. Arrange piping completely above the auxiliary drain pan as described under Drain Pans paragraph.
6. Insulate hot water piping. Insulate any chilled water and dual temperature piping that cannot be located above the auxiliary drain pan.
7. Insulate with closed cell elastomeric insulation per Related Specification Sections.
8. Install piping to allow access to all piping components (drain connections, unions, etc.), arranged so that it is possible to remove the control valve body and actuator without removing any other component.
9. Provide adequate and easily removable pipe hangers. Hangers shall rigidly support the pre-assembled piping package from the fan coil chassis, preventing damage during shipping and operation. Provide plastic coated hangers to prevent galvanic corrosion between hanger and piping components.
10. Provide plastic end caps on the field connection points.

2.8 SOURCE QUALITY CONTROL

A. Factory test all coils with a minimum of 350 psig air pressure while submerged under water.

B. Assemble and factory test each unit prior to shipping. Pressure test coils and piping packages for leaks. Cycle controls and operate fan at all speeds to check for proper operation. Correct all deficiencies prior to shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine rough-in construction for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan coil units level and plumb. Adjust leveling legs individually to the minimum height required to level units. Do not use leveling legs to align coil connections with field piping - adjust field piping instead.

B. Bolt unit to blocking in wall after leveling. Bolt units to floor if inadequate wall support exists in the wall. Do not use toggle bolts or dry-wall anchors. Install bolts in every fan coil mounting hole.

C. Install fan coil units to comply with Quality Assurance Standards and manufacturer’s installation instructions.

3.3 CONNECTIONS AND INSULATION

A. General piping installation requirements are specified in Related Work Specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Install as follows:

1. Connect hydronic and condensate drain piping to the unit.
2. Install piping to allow access to all piping components (drain connections, unions, etc.), arranged so that it is possible to remove the control valve body and actuator without removing any other component.
3. Provide adequate and easily removable pipe hangers to rigidly support piping within the fan coil. Provide plastic coated hangers to prevent galvanic corrosion between hanger and piping components.
4. Arrange chilled water and dual temperature piping so that it is installed completely above the auxiliary drain pan, to capture any condensate dripping from the piping.

B. Insulate condensate drain and hot water piping with closed cell elastomeric insulation per Related Specification Sections. Insulate any chilled water and dual temperature piping that cannot be located above the auxiliary drain pan.

1. Insulate piping all the way to coil headers and drain pan connection.
2. If fan coil unit is provided with pre-assembled hydronic piping package under the Alternate Work, provide insulated piping, as described in the Part 2 article. Insulate all field installed piping as described above.

C. Connect wiring and ground equipment according to electrical requirements indicated in the Related Specification Sections.

3.4 CLEANING AND PROTECTING

A. Protect units from damage, scratching, dirt and debris immediately after installation as follows:

1. Wrap or cover entire cabinet with heavy plastic. Completely cover return air inlet. Secure plastic in place with tape.
2. Cover entire cabinet with heavy cardboard secured in place. Utilize fan coil shipping box when possible. Mark top with large letters stating, "FRAGILE – DO NOT STAND."
3. Use only tape that will not mar finishes. Clean and remove all tape and adhesive residue prior to starting units.
4. Remove all protective materials immediately prior to starting each unit. Do not uncover any unit before all drywall taping and sanding has been completed in that area.

3.5 TEMPORARY USE PRIOR TO OCCUPANCY

A. Start fan coil units for temporary use only with the express written permission of the Owner and compliance with all requirements of the Contract Documents.

B. Complete all drywall taping, sanding and finishing in an area prior to any early use of fan coil units serving that area.

C. Prior to starting each unit, remove front access cover and vacuum complete unit including coils, fan scrolls, drain pans, access sections, chassis, and cabinet.

D. Perform manufacturer's pre-start protocol and commissioning activities immediately prior to placing into temporary service.

E. Tape foam filter material over entire discharge grille.

F. Install a complete set of temporary filters in the fan-coil unit equal to the quality and efficiency of the specified permanent filters. If the fan coil unit was equipped with pre-installed filters, they may be used for temporary service. Provide factory new, clean filters in units at final turn over to the Owner.

G. During temporary service, perform all manufacturer's recommended and required routine maintenance procedures, including filter replacement at regular intervals, as required. Continuously maintain a log of all such procedures completed. Store log at unit during temporary use period and include log as part of the final Operation and Maintenance Manual.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
2. Test unit operation with thermostat in all modes of operation.
3. Verify that drain pans collect all condensate and are properly sloped to drain so that no condensate is retained in the pans.

4. Remove and replace malfunctioning units and retest as specified above.

ENGINEER SHALL VERIFY THAT THE MECHANICAL SYSTEMS CONTROLS SPECIFICATION DESCRIBES CONTROLS START-UP FOR FAN COIL UNITS.

B. Coordinate controls start-up for fan coil units with the Mechanical Systems Controls Specifications.

3.7 COMMISSIONING

A. Perform complete functional testing as required by the Commissioning Agent.

B. Perform manufacturer's pre-start protocol and commissioning activities after unit has completed temporary service.

3.8 FINAL TURN-OVER TO OWNER

A. Immediately prior to Substantial Completion, re-clean all fan-coil units. Remove front access cover and vacuum complete unit including coils, fan scrolls, drain pans, access sections, chassis, and cabinet. Clean and remove all tape and adhesive residue from cabinet.

B. Straighten coil fins with a fin comb.

C. Sand, prime coat, and touch-up all scratches with color-matched, factory-supplied touch-up paint. Where touch-up painting does not match adjacent, unblemished finish in either color or texture, field paint the entire cabinet surface exposed to view with factory-provided spray paint.

D. After final cleaning and painting, install a new, clean set of air filters in each unit if units were used for Temporary Use.

REVISE TO COORDINATE WITH PART 1 SUBMITTALS IF SPARE FILTERS ARE REQUIRED.

E. Provide spare filters to Owner.

3.9 OWNER TRAINING

A. In cooperation with the Commissioning Agent, train Owner's personnel on basic fan-coil unit maintenance by demonstrating the following: location of control devices, removal of access panel, filter replacement, relay replacement, and motor replacement.

END OF SECTION 238219