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BuildingName
The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23
SECTION 237324 - SEMI-CUSTOM AIR HANDLING UNITS

END OF CONTENTS TABLE

DIVISION 23
SECTION 237324 - SEMI-CUSTOM AIR HANDLING UNITS

REVISED NAME FROM "MODULAR" TO "SEMI-CUSTOM" AIR HANDLING UNITS AT THE REQUEST OF THE HVAC/CONTROLS GROUP. D. KARLE 4/14/08.

REVISED TO REQUIRE CERTAIN PRODUCT DATA W/SUBMITTALS, AND AIR-TO-AIR HX SPEC., ALL PER MECH TECH TEAM. D. KARLE, 7/29/08.

MINOR IMPROVEMENTS TO ELECTRICAL AND TEMPERATURE CONTROL WIRING SECTION BY K. BIRRINGER AND D. KARLE, 7/1/09

REMOVED REFERENCE TO AHRI 410, WHICH IS COVERED IN 238216. D. KARLE FOR MECH TECH TEAM 9/11/09.

REVISED TO ELIMINATE SEALTITE AND FIBERGLASS LIGHT FIXTURES DUE TO NEC CODE CHANGE. CLARIFIED FILTER REQUIREMENTS DURING TEMPORARY USE. D. KARLE FOR MECH TECH TEAM, 3/26/10.

GENERAL IMPROVEMENT OF CONTENT ARRANGEMENT AND REVISION TO NEW FORMAT, MARCH 2011.

THERMAL CORP AND VENTROL ADDED AS APPROVED 3/26/13, PER HVAC MTT.

8/2015: ADDED SPEC EDITORS NOTE UNDER PART 1 REGARDING ENERGY WHEELS. D. KARLE PER HVAC MTT.

11/2015: ADDED INGENIA AS APPROVED MFR. D. KARLE PER HVAC MTT.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air handling units of semi-custom construction consisting of modular sections.

AIR HANDLERS COVERED BY THIS SPECIFICATION ARE NON-CUSTOM TYPE FOR LIGHT TO MEDIUM DUTY USE.

REVISE CAREFULLY IF SPECIFICATION IS TO BE USED FOR PREPURCHASE; TO SPECIFY WHO PROVIDES FILTERS FOR THE AIR HANDLER IF IT WILL BE USED FOR TEMPORARY SERVICE. IT IS SUGGESTED THAT THE AIR HANDLER SUPPLIER PROVIDE ONE SET OF FILTERS, AND THE MECHANICAL CONTRACTOR RUNNING THE UNIT DURING TEMPORARY SERVICE PROVIDE THE ADDITIONAL FILTER SETS, SINCE IT IS UNKNOWN HOW MAY FILTER SETS WILL BE REQUIRED DURING TEMPORARY OPERATION. THIS SECTION SPECIFIES FILTERS SUPPLIED IN THIS MANNER (PER PART 2, MFR. SUPPLIES FILTERS WITH UNIT. PER PART 3, UNIT MUST BE TURNED OVER WITH NEW FILTERS).

THIS SPEC CANNOT BE USED STAND-ALONE FOR AIR HANDLERS! THE RELATED SPEC SECTIONS LISTED IN PART 1 MUST BE INCLUDED IN THE

PROJECT SPEC BOOK TO PROVIDE THE COMPLETE REQUIREMENTS. HOWEVER, INFO IN THIS SECTION IS COMPLEMENTARY TO THOSE RELATED SECTIONS; THEREFORE DO NOT DELETE, FOR EXAMPLE INFO IN THIS SECTION REGARDING COILS, DRAIN PANS, FILTERS, ETC.

U-M HAS EXPERIENCED ONGOING ISSUES WITH LEAKAGE BETWEEN SUPPLY AND EXHAUST AIR STREAMS ON AIR HANDLERS EQUIPPED WITH ROTARY AIR-TO-AIR ENERGY RECOVERY WHEELS (HIGHER THAN PREDICTED BY MFR.S). THEREFORE IT IS GENERALLY RECOMMENDED THAT AIR HANDLERS EQUIPPED WITH THESE DEVICES BE SPECIFIED AS CUSTOM AIR HANDLERS SO THAT THE UNITS ARE FACTORY TESTED. IF SEMI-CUSTOM AIR HANDLERS ARE TO BE SPECIFIED WITH THESE DEVICES, THE DESIGNER SHOULD CONSIDER ADDING FACTORY TESTING (WHICH CAN BE COPIED FROM THE CUSTOM AHU SPEC) TO THIS SECTION.

1.2 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.

B. Related Sections:

1. Section 220500: Common Work Results for Mechanical.
2. Section 220513: Motors.
3. Section 220548: Vibration Control
4. Section 238216: Coils and Drain Pans
5. Section 233400: Fans
6. Section 234000: HVAC Air Cleaning Devices
7. Section 233300: Air Duct Accessories and RGDs
8. Section 230900: Mechanical Systems Control
9. Section 230593: Testing, Adjusting, and Balancing.
10. Division 26: Electrical.

1.3 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise.

1. ANSI/AHRI Standard 430. Performance Rating of Central Station Air-Handling Units.
2. AHRI Standard 260- Sound Rating of Ducted Air Moving and Conditioning Equipment.
3. NFPA 70 National Electric Code.
4. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems

1.4 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer shall provide shipping protection to insure that the interior and exterior of each unit is completely protected from dirt or weather. Duct and pipe openings shall be covered with sealed sheet metal, plastic or other durable means to ensure unit cleanliness is maintained.

B. Support coil headers independently during transport to prevent potential damage from vibration.

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

1.5 SUBMITTALS

A. For each unit, submit for approval, the following product data:

1. Overall unit dimensions, weight, and center of gravity.
2. Ductwork connections including sizes, locations, and methods of connecting to mating ductwork.
3. Piping connections including size, material types, and dimensioned locations for each service.
4. Detail methods of sealing inner and outer walls at locations of pipe penetrations.
5. Locations and sizes of access doors.
6. Details of access door handles, latching mechanisms, hinges, and vision panels.
7. Locations of interior light fixtures and light switches.
8. Locations of electric power convenience receptacles.
9. Dimensions, weights and centers of gravity for each section when units will be shipped in multiple sections.
10. Cabinet material, metal thickness, finishes, insulation and accessories.
11. Details of vibration isolation bases including selections for vibration isolation springs.
12. Details of fan discharge flexible duct connector where required.
13. Details of motor and belt guards.
14. Motor mfg., ratings, electrical characteristics, and motor accessories.
15. Sound power level data per AHRI Standard 260.

REVISE WARRANTY PER PROJECT. LONGER WARRANTY PERIOD MAY BE APPROPRIATE FOR CERTAIN TYPES OF WORK. INCLUDE THIS ARTICLE IN EVERY SPECIFICATION SECTION.

1.6 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Buffalo Air Handling.
2. TMI Custom Air Systems.
3. Nortek Air Solutions - Governair Division.
4. Mafna Air Conditioning, Inc.
5. Air Flow Equipment.
6. Daikin Applied
7. Thermal Corporation
8. Nortek Air Solutions - Ventrol Division
9. Ingenia
10. Jonson Controls Inc/York - Solution XTI (Indoor), Solution XTO (Outdoor)

2.2 GENERAL

A. Provide factory fabricated, double-wall air handling units with components and equipment as scheduled and detailed on Drawings.

B. Components shall be fabricated in major sections at the Manufacturer's factory and shall carry the Manufacturer's nameplate.

C. Provide units of height, width, and length indicated, and that comply with project weight and spatial limitations.

1. Weight, spatial, and dimensional limitations shall also apply to individual sections, including facilitate unit rigging and installation.

D. Provide a minimum of four lifting lugs per separately shipped section, of adequate strength to allow rigging without damage.

E. Manufacturer shall supply gasketing, sealant, and installation instructions.

F. Manufacturer shall provide touch-up paint(s) for use after field assembly.

G. Touch up all galvanized surfaces damaged from welding or other fabrication operations with zinc rich paint, minimum 65 percent metallic zinc by weight.

2.3 COMPONENTS- GENERAL REQUIREMENTS

A. Provide all components integral to the air handling unit including, but not limited to, the following. These components shall comply with Related Sections and any additional requirements of this Section.

EDIT THESE ITEMS FOR EACH PROJECT

1. Motors
2. Vibration Isolation
3. Coils and Drain Pans
4. Fans and Accessories
5. Air Filters
6. Sheet Metal Accessories
7. Dampers (as specified in Controls section)
8. Energy Recovery Wheels/Heat Exchangers
9. Sound Attenuators

2.4 MANUFACTURING

A. Casings shall be manufactured only after panel components (structural members, facing sheets and insulation) have been thoroughly cleaned of mill grease, dirt and oxidation.

1. Interior and exterior of panel system shall be thoroughly protected from contamination from the manufacturing process through start-up procedures and acceptance.
2. Internal components (fans, coils, air filter frames, equipment and piping) shall arrive from their respective manufacturing facilities free of grease and dirt.

B. In general, products such as sealants and gaskets, used within the unit, shall be non-petroleum based products, with no outgassing characteristics.

C. Equip, prepare, identify and match-mark individual shipping sections so that field reassembly and installation can be performed without reworking, interchanging, adjusting, springing, drilling new bolt holes, etc. All supplemental supplies necessary to assemble the unit shall be provided by the Manufacturer.

2.5 UNIT HOUSING

A. Maximum Casing Leakage (inclusive of all components):

1. Shall not exceed 1 percent of the scheduled design air flow at 6 in. wg positive or 4 in. wg negative static pressure, or:
2. 1 percent of the scheduled design air flow at the scheduled casing pressure ratings, when such ratings are scheduled.

B. Construction

1. The unit shall be constructed of modules with a complete frame with removable side and bottom panels. Frame-less construction with removable panels for coil and fan access may also be supplied. For either type construction, removal of panels shall not affect the structural integrity of the unit.
2. The unit shall be equipped with a base rail or similar support structure so that the bottom of the unit does not rest directly on the housekeeping pad or floor. The base rail/supports shall be designed to allow the unit to be leveled with shims and anchored to the pad or floor.
3. Minimum wall panel thickness shall be 2 in.

IF CONDITIONS WARRANT, SELECT THE SPECIFIC CASING MATERIAL BY EDITING B.4, OTHERWISE THE MFG. MAY PROVIDE ANY OF THE 3 LISTED.

4. Interior and exterior casing shall be G-90 galvanized steel, aluminum, stainless steel, or as scheduled.
5. The casing shall be able to withstand up to 6 in. wg positive or 4 in. wg negative static pressure, or as scheduled.
6. Maximum deflection of walls, floors, and roof shall be L/250 (L = span in inches.), under the following conditions:
   a. Wall deflection maximums are at 6 in. wg positive or 4 in. wg negative static pressure, or at scheduled pressures. .
   b. Floor deflection maximum: 150 lbs. /sq. ft.
   c. Roof deflection maximum: 75 lbs/sq. ft. plus snow load
7. Outdoor design conditions:
   a. Minimum wind load: 120 mph.

b. Minimum snow load: 50 lbs/sq ft or per code, whichever is greater.

8. Modules shall be factory-insulated. Insulate walls, roof, and entire bottom, including below drain pans. Insulation and insulation adhesive shall comply with NFPA-90A requirements for flame spread and smoke generation and be rated UL Class 1. Insulation adhesive shall be UL-listed.

SELECT EITHER SOLID (B.9) OR PERFORATED (B.10) INNER WALL. AVOID PERFORATED WALLS WHENEVER POSSIBLE.

9. Module panels shall be of double-wall construction to facilitate cleaning of the unit interior. The interior wall shall be solid. Fiberglass insulation shall be 3 lbs./cu.ft. density. Insulation thermal resistance R shall be a minimum of 8.33 $ft^2 \cdot h \cdot °F/Btu$.
10. Module panels shall be of double wall construction, fabricated from solid wall at cooling coils and humidifiers with the balance of the inner wall perforated to enhance acoustical performance. Foam insulation shall not be used behind perforated panels. Configure perforation spacing and hole size to prevent insulation breakaway, flake off, or delamination when tested at 9,000 fpm, in accordance with UL Standard 181. Thermal resistance R shall be 8.33 $ft^2 \cdot h \cdot °F/Btu$.

C. Ductwork Connections

1. Provide flanged connections with flanges extending a minimum of 2 in. past the outside wall of the unit.

D. Roof

1. For units located inside, roof performance shall match all panel performance requirements.
2. For units located outside, no penetrations shall be made through roof. Slope roof to prevent standing water.

E. Paint

1. Prior to assembly, paint all non-galvanized ferrous metal parts with two coats of lead-free rust-inhibitive, alkyd-based primer paint.
2. For exterior units, paint exterior surfaces with two coats of alkyd exterior enamel paint. Properly prepare all surfaces prior to painting according to paint manufacturer's instructions.

F. Access Doors and Panels

1. Access doors and panels shall be of same construction as unit housing, including insulation.
2. Doors shall be minimum 18 in. wide, 24 in. wide is preferred, or widths as indicated on drawings. Provide doors that are the full height of the unit, maximum 6ft. high.
3. Each access door and panel shall be equipped with continuous gaskets and shall fit in the door frame in a manner to guarantee the unit’s specified leakage criteria.

4. Indoor unit hinges and hardware shall be galvanized, stainless steel,aluminum, or fiberglass reinforced nylon (Klima-flex or similar). Outdoor unit hardware shall be stainless steel, aluminum, or fiberglass reinforced nylon (Klima-flex or similar). At least 2 handles per door, operable from either side, shall be provided.
5. Access doors in positive pressure sections shall open inward. Access doors in negative pressure sections shall open outward.

STRIKE THE FOLLOWING IF DOOR WINDOWS ARE NOT TO BE PROVIDED.

6. Unless otherwise noted, each door shall contain a safety glass window. Provide double pane non-fogging thermal windows downstream of cooling coils, single or double pane non-fogging type elsewhere. Each window shall be a minimum 6 in. by 6 in. properly sealed to prevent leakage and condensation, and be able to operate safely against the unit's positive and negative pressure capabilities.
7. Removable access panels shall be provided in unit sections where components contained are larger than the respective access module door opening.

G. Outside and exhaust air openings

1. Outside air and exhaust openings shall be furnished with 25 mesh, galvanized bird screen. Rain hood velocities shall not exceed 1000 FPM.

2.6 COMPONENTS

SELECT LOUVERS IN COORDINATION WITH ARCHITECT. ENSURE LOUVERS ARE NOT ALREADY SPECIFIED IN ARCH DIVISIONS. DELETE THE PARAGRAPH BELOW IF LOUVERS ARE SPECIFIED BY THE ARCHITECT.

A. Louvers

1. Provide louvers as shown and scheduled on drawings. Louver airstream shall not entrain water or snow.
2. Louvers shall be self-draining.

MIXING OF OUTSIDE AIR AND RETURN AIR STREAMS SHOULD OCCUR OUTSIDE THE AIR HANDLER. AVOID MIXING BOXES WHICH ALMOST ALWAYS RESULT IN STRATIFICATION (FREEZE STAT TRIPPING) PROBLEMS.

B. Mixing Box Section

1. The outside and return airstreams shall be directed into each other in a mixing box by parallel blade damper assemblies oriented to facilitate mixing of the airstreams.

C. Face and Bypass Modules

1. Face and bypass modules shall be provided as shown on the drawings.
2. Bypass shall be the external type, routed to a factory fabricated opening located downstream of all coils. The pressure drop through the bypass shall be equal to the pressure drop through the coils.
3. Dampers shall be opposed blade at the coil and either opposed or parallel blade at the bypass. Dampers shall be mechanically linked together.

4. Damper construction shall be per the Related Section.

D. Dampers

1. Provide dampers as specified in Related Section Mechanical Systems Controls.
2. In addition to the requirements in Mechanical Systems Controls, dampers designated as smoke dampers shall be labeled in accordance with the latest editions of UL 555S.

E. Sound Attenuators

1. Provide sound attenuators where shown integral to air handling unit, as scheduled on Drawings and as specified in Related Section.

F. Filters

1. Provide filters and filter gauges of types as shown and scheduled on drawings and as specified in Related Section.

BLENDERS ARE NOT PREFERRED. MIXING OF OUTSIDE AIR AND RETURN AIR STREAMS SHOULD OCCUR OUTSIDE THE AIR HANDLER TO AVOID THE NEED FOR BLENDERS WHICH HAVE GENERALLY PROVEN TO BE INEFFECTIVE.

G. Blender Assembly

1. Blender assemblies shall be welded, rigid, vibration and deflection free, and adjustable; designed to impart a counter-rotational mixing to the air stream, producing a minimum standard deviation through a plane parallel with the blenders between entering air streams.
2. Mixing performance: Constant from 500 fpm to 2,500 fpm blender velocity.
3. Minimum mixing effectiveness: 80percent and +/- 5 deg F standard deviation when mixing 30percent outdoor air/70percent return air at 50 deg F inlet temperature differential. Capable of acceptable performance throughout entire operating range of unit, including system turndown.
4. Blender material shall be the same as the casing interior material.
5. Acceptable Manufacturers:
   a. RM Products
   b. Blender Products, Inc.

THE FOLLOWING SPECIFICATION FOR AN AIR TO AIR HEAT EXCHANGER (IN HIDDEN TEXT) IS PROVIDED FOR CONVENIENCE AND SHALL BE EDITED TO BE PROJECT SPECIFIC. "TURN ON" THIS TEXT IF REQUIRED.

H. Air-to-Air Heat Exchanger Section

1. Minimum capacities shall be as scheduled on the Drawings.
2. Heat exchanger shall be furnished as an integral part of the overall air-handling unit.
3. Heat exchanger shall be a cross-flow, fixed-plate exchanger with a diamond-shaped cross section. Plates shall be fabricated of aluminum and formed with profiles that maximize heat transfer and minimize pressure loss. Frames shall be constructed of galvanized steel and/or aluminum. Configuration shall allow for access and cleaning of each of the air pathways.

4. Furnish the heat exchanger with bypass dampers and a bypass air pathway to allow for the automatic prevention of frost formation on the plates. Provide dampers as specified in the Related Section "Mechanical Systems Controls".
5. Casing for the heat exchanger shall be constructed to the standards indicated elsewhere in this section for the overall air-handling unit. Provide baffle plates to seal and separate the two air streams from each other. Provide condensate drain pan(s) in compliance with Related Section, beneath the heat exchanger media.
6. Provide the air handling unit a total of 4 access sections at the inlet and discharge of each air path. Each access section shall be furnished with an access door.

I. Coils and drain pans

1. Provide preheat, energy recovery, heating, cooling coils and associated drain pans as shown and scheduled on Drawings and as specified in Related Sections.
2. Provide drain pans and drain connections for the following sections: cooling coils, humidifiers, and energy-recovery coils or wheels.
3. All coil assemblies shall be safed on top and bottom and at all coil splits.
4. Drain pans shall be sloped in a minimum of 2 planes to eliminate standing water and shall be stainless steel construction. Drain pans shall be constructed of adequate downstream length to collect any condensate that blows off the coil at air velocities up to the design air flow rate or 500 FPM, whichever is greater.
5. Insulate drains pans, including intermediate drain pans, to prevent sweating.
6. All coil assemblies shall be removable without disruption to other unit components or coils. Fasten coil assemblies with bolts or screws per manufacturer's recommendations (welds or rivets are not acceptable).
7. Extend coil connections, vents and drains to the outside of the air handling unit casing to allow field connections.
8. Label coil inlet, outlet, vent and drain piping connections with labels applied outside the casing.

J. Diffuser Modules:

1. A diffuser module shall be provided immediately downstream of the fan module on blow through units. The diffuser shall provide equal air distribution to components immediately downstream of the diffuser. Diffusers shall be made of G90 galvanized steel, stainless steel, or aluminum.

THIS SECTION SPECIFIES BACKWARD OR AIR FOIL STYLE FANS WHICH ARE PREFERRED IN MOST CASES. HOWEVER ON SOME SMALL AIR HANDLERS A FORWARD CURVED FAN MAY BE A MORE APPROPRIATE CHOICE, IN WHICH CASE EDIT THE BELOW.

K. Fans and Accessories

1. Provide fans and accessories as shown and scheduled on drawings and as specified in Related Section. Fans shall be backward inclined or air foil type.

2. Isolate the fan from the unit casing by flexible duct connection(s) and a spring isolation base

THIS SECTION REQUIRES ACCESS SECTIONS BE PROVIDED TO ALLOW BOTH UP AND DOWNSTREAM ACCESS TO EVERY MODULE COMPONENT. THE DESIGNER MUST ACCOMMODATE THESE ACCESS SECTIONS WHEN FITTING UNITS INTO THE AVAILABLE SPACE.

L. Access/Inspection Sections: Modules shall include an access section complete with a double-wall door. Access sections shall be provided to allow up and down stream access to every module component.

CONSIDER MOISTURE ELIMINATORS WHEN LESS THAN IDEAL CONDITIONS EXIST AT OUTSIDE AIR INTAKES OR HUMIDIFIERS.

M. Moisture Eliminator Module

1. A module consisting of a vertically mounted, maintenance-free moisture eliminator shall be provided. The moisture eliminator shall consist of “sine-wave” fins or stainless steel mesh for effective moisture removal.
2. Moisture eliminators shall be made of stainless steel or aluminum, of rigid construction, and be vibration and deflection free.

AIR HANDLERS ARE NOT SPECIFIED TO BE EQUIPPED WITH DISCONNECTS. DISCONNECTS ARE NOT TYPICALLY REQUIRED FOR FANS DRIVEN BY VFDS; SEE DESIGN GUIDELINE 220514 FOR MORE INFO. FOR FANS NOT DRIVEN BY VFD'S, REQUIRE THE ELECTRICAL ENGINEER TO INDICATE A DISCONNECT. DISCONNECTS SHALL BE MOUNTED OUTSIDE FAN CASINGS.

N. Electrical and Temperature Control Wiring

1. Provide a junction box on the outside of the fan section casing for single point connection of external power wiring to each unit fan motor.
2. Provide EMT and flexible metal conduits and wiring between the junction boxes and the motor(s). Final connections to motors shall be 1/2" minimum flexible metal conduit with steel fittings.
3. For each unit section that has an access door, provide a minimum of one 120V vapor-proof marine light with an LED lamp suitable for use in enclosed fixtures.
4. Provide a single light switch with red pilot light adjacent to the latch side of the fan section door to control all of the unit’s lights. Pilot light shall be "on" when associated light fixture is "on."
5. Provide a junction box on the outside of the unit for single point connection of external power wiring to the unit's lights. Provide EMT conduit and wiring between the junction box, switch, and associated lights. Provide flexible conduit “whips” with wiring at section splits, for reconnection of the lighting circuit by the Electrical Contractor after sections are assembled.
6. Provide all electrical components in accordance with NFPA 70 (NEC) and Division 26 requirements. Indoor electrical enclosures shall be rated NEMA 1. Electrical enclosures located outdoors shall have a NEMA 3R rating.

7. All electrical and temperature control wiring shall be run in conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use spreader bars with lifting cables and hoist sections from lifting lugs, to prevent cable damage to sections.

B. Install on concrete housekeeping pad. Coordinate final pad size and location in field

C. When indicated, install units on steel supports. Coordinate final location and placement of steel supports and ductwork connections in field

D. Secure the unit to the floor or housekeeping pad with suitable anchors bolted through the unit's base rail or support feet. Prior to anchoring, level unit in all directions with stainless steel shims.

E. Openings to ductwork and piping shall remain protected and covered until just prior to connection of utilities, or unit assembly. Immediately after unit assembly, restore all factory protection. Maintain protection after assembly until just prior to final acceptance by Owner.

F. Make piping and duct connections, install filters and unit accessories, and complete all work required to place the unit into service

3.2 TEMPORARY USE OF AIR HANDLING UNITS

A. Thoroughly clean unit of all grease, dirt, dust, etc.

B. Prior to placement into temporary service:

1. Perform manufacturer's pre-start protocol.
2. Perform commissioning activities.

C. Perform all manufacturer's required routine maintenance procedures during temporary service. Continuously maintain a log of such procedures. Store log at unit during temporary use period and include log as part of the final O&M manual.

D. While operating the air handler for temporary use, install a complete set of filters in the air handling unit of the same quality and efficiency as the specified permanent filters for the project.

BELOW PARAGRAPH REQUIRES MINIMUM MERV 8 FILTERS TO PROTECT DUCT WORK DURING CONSTRUCTION, WHICH MATCHES LEED REQUIREMENTS AND IS RECOMMENDED FOR NON-LEED PROJECTS AS WELL.

SOME SPECIALTY INSTALLATIONS (E.G. CLEAN ROOM OR CLEAN-ROOM-LIKE SPACES) MAY REQUIRE THAT TEMPORARY DUCTWORK FILTERS BE EQUIVALENT TO SECONDARY FILTER PERFORMANCE. IF THAT IS THE CASE, REVISE BELOW ACCORDINGLY.

E. Provide temporary filters, minimum MERV 8, to protect all ductwork and building contents when unit is operated during construction. Filters shall have an equal or better performance rating than primary filters specified for permanent use in order to prevent construction dirt infiltration into the air handling unit systems.

F. Continuously maintain all filters and replace when pressure drop exceeds 1 inch w.c., or at manufacturer's recommended change-out pressure drop, whichever is lower.

3.3 FIELD QUALITY CONTROL

A. Units shall undergo air and water balance and vibration testing per Related Section Testing, Adjusting and Balancing.

3.4 COMMISSIONING

A. Perform the commissioning activities as outlined in the Division 01 Section Commissioning and other requirements of the Contract Documents.

3.5 ADJUSTING, CLEANING, PROTECTION

A. After unit has completed any temporary service and just prior to final acceptance by Owner, contractor shall:

1. Thoroughly clean unit of all grease, dirt, dust, etc., lubricate bearings, align and tighten belts, and perform manufacturer's pre-start protocol
2. Install a new, complete set of filters.
3. Perform all commissioning activities, even if previously performed to ready for temporary service.
4. Touch up damaged galvanized surfaces with zinc rich paint, minimum 65 percent metallic zinc by weight.
5. Touch up damaged painted surfaces with manufacturer provided touch-up paint.

END OF SECTION 237324