**EQUIPMENT APPROVALS**

|  |  |  |  |
| --- | --- | --- | --- |
| **SECTION** | | **ITEM** | **PROPOSED SUBSTITUTION** |
|  |  |  |  |

**SPECIFICATIONS**

**Note:** Revised Additions are in bold, deletions have a strikethrough.

SECTION 23 07 00 - HVAC INSULATION

1. Article 3.02, A, 3 and 5: Add to line items 3 and 5 as follows:

3. All outside air intake ducts **and plenums.**

4. All ductwork required to be insulated by code.

5. All relief ducts **and plenums.**

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

1. Article 4.08, C: Add to paragraph C as follows:

C. For new systems with multi-stage cooling or heating modify sequences for modulation/staging of units as required. **This includes AC-1 to 7 and furnace systems 1-6.**

SECTION 23 30 00 - AIR DISTRIBUTION

1. Article 3.06: Add new item and paragraphs as follows:

3.06 existing duct cleaning

**A. Return and Outside Air Duct System Cleaning.**

**1. Clean all main trunk lines.**

**2. Clean all ductwork of return air grills.**

**3. Install additional entry points as needed to provide thorough cleaning.**

**4. Seal access points after cleaning.**

**5. Mark location of manually operated dampers and air-direction devices before cleaning and return to marked position upon completion.**

**6. Protect all furniture and equipment during cleaning.**

**7. Replace filters if provided by the school district.**

**8. Return all ceiling tiles, access panels, and any furniture or equipment moved to original position.**

**9. Clean up all debris created by cleaning.**

**10. Provide before and after pictures of ductwork to owner upon completion.**

**11. See section B for details.**

**B. Detailed Duct and Equipment Cleaning.**

**1. The ACR NADCA Standard 2013 will be referenced in this procedure. References made to that standard by default include the supporting information (definitions, terms, etc.) of that document. References to NADCA reference the standard.**

**Comply with sections 2 and 3 of NADCA**

**Procedure:**

**2. Service Openings: Service openings may be needed to perform assessment, cleaning and restoration (ACR) procedures. Below are the minimum requirements for service openings.**

**a. Service openings installed into the system shall not degrade the structural, thermal, or functional integrity of the system.**

**b. Service openings shall be created in a manner that allows for proper closure.**

**c. Service openings shall not hinder, restrict, or alter the airflow within the air duct.**

**d. Service opening construction materials and methods shall be in compliance with industry standards and local codes, using materials acceptable under those standards and codes.**

**3. Materials used in the fabrication of duct access doors and permanent panels shall be those classified for flammability and smoke spread if the material is exposed to the internal airstream. These materials are classified as having a flame-spread rating of not over 25 without evidence of continued progressive combustion and a smoke-developed rating of not over 50, as determined by UL 723.**

**4. All tapes used in the installation and closure of service openings shall meet the requirements of UL 181A.**

**5. All service openings shall comply with applicable UL, SMACNA and NFPA standards, as well as local, regional, and state codes.**

**6. Service Panels:**

**a. Service panels used for closing service openings in the HVAC system shall be of an equivalent gauge or heavier so as to not compromise the structural integrity of the duct.**

**b. Service panels used for closing service openings shall be mechanically fastened (screwed or riveted) at minimum every 4" on center. The panel shall overlap the ductwork surfaces by a minimum of 1" on all sides.**

**c. It is recommended that service panels used for closing service openings be sealed with gaskets, duct sealants, mastic, or tape.**

**7. Prefabricated Duct Access Doors: The gauge of the duct access door shall be based on the pressure class of the duct system and shall be installed according to manufacturer’s specifications.**

**8. Drilled 1" Service Openings: Drilled 1" service openings shall be closed with materials meeting UL 181 for smoke generation and flame spread.**

**9. Flexible Duct Systems: Service openings shall not be made in flexible ductwork.**

**10. Cleaning and Restoration of HVAC Systems: HVAC systems shall be cleaned by using a suitable agitation device to dislodge contaminants from the HVAC component surface and then capturing the contaminants with a vacuum collection device.**

**11. Wet Cleaning, Power Washing, and Steam Cleaning: Wet cleaning, power washing, steam cleaning and any other form of wet process cleaning of HVAC system components shall not damage or result in subsequent damage to the components. Cleaning agents or water shall never be applied to electrical, fibrous glass or other porous HVAC system components.**

**12. Vacuum Collection Equipment: Vacuum collection equipment shall be operated continuously during cleaning. The collection equipment shall be used in conjunction with agitation tools and other equipment to convey and collect debris and prevent cross-contamination of dislodged particulate during the mechanical cleaning process. Maintain capture velocities per NADCA 4.5.**

**13. Confined Space Cleaning: When working inside a confined space, health and safety concerns shall be a priority. The duct support system, internal components, configuration and confined space concerns shall be evaluated for safety prior to entry. It is recommended that a Certified Safety Professional be consulted as needed.**

**14. Air-Handling Unit (AHU) Cleaning: It is recommended that air-handling coils, fans, condensate pans, drains and similar non-porous surfaces be wet cleaned in conjunction with mechanical methods.**

**a. Efforts to control water extraction shall be sufficient to collect debris and prevent water damage to the HVAC components and surrounding equipment and structure.**

**b. The capture, containment, testing and disposal of waste water generated while performing wet cleaning shall be in accordance with applicable local, regional, state, and federal regulations.**

**15. Air Duct Cleaning: Air ducts shall be cleaned to remove all non-adhered substances and shall be capable of passing NADCA cleanliness verification tests.**

**a. Air ducts shall be accessed through service openings in the system that are large enough to accommodate mechanical cleaning procedures and allow for cleanliness verification.**

**b. Air ducts shall be cleaned using mechanical agitation methods to remove particulate, debris, and surface contamination.**

**c. Dislodge substances shall be captured with a vacuum collection device.**

**d. Cleaning activities shall not damage any HVAC components.**

**16. Dampers: Dampers and any air-directional mechanical devices shall have their position marked prior to cleaning and shall be restored to their marked position after cleaning.**

**17. Registers, Grilles, Diffusers: It is recommended that all registers, grilles, diffusers, and other air distribution devices be removed if possible, properly cleaned, and shall be restored to their previous position.**

**18. Smoke and/or Fire Detection Equipment: Cleaning activities shall not impair, alter or damage any smoke and fire detection equipment located within the facility, or attached to and serving the HVAC system.**

**19. Post-Cleaning Inspection: If debris still remains on the coil after cleaning, the process shall be repeated.**

**20. Control of Odors and Product Emissions: All products used shall comply with any local, regional, state, and federal regulations and/or other laws regulating the use of such agents.**

**21. Remediation of Mold Contamination: Remediating mold shall be performed in accordance with the IICRC S520 Standard for Professional Mold Remediation and the cleaning/restoration of the HVAC system provisions as outlined within this Standard.**

**22. Surface Treatments: Surface treatments may be used to restore the integrity of material surfaces as an alternative to replacement. Surface treatments shall only be applied after confirming the system has been cleaned and has passed the specified level of cleanliness verification.**

**23. Removal of Mold Contaminated Porous Materials: It is recommended that porous materials with mold growth (Condition 3) be properly removed and replaced. This task shall be followed by surface cleaning using mechanical cleaning methods.**

**a. The mechanical cleaning methods selected for duct liner or fibrous glass duct board shall not create abrasions, breaks, or tears to fibrous glass liner or duct board surfaces.**

**24. Resurfacing Fibrous Glass Surfaces: Resurfacing may be considered when thermal acoustic fibrous glass components, including air duct liner or duct board in the HVAC system, are considered friable, or exhibit visual signs of abrasion, degradation, or other undesirable conditions. Resurfacing may also be considered when the project work plan requests smoothing fiber glass surfaces to reduce future particulate collections within the HVAC system.**

**a. If resurfacing is to be performed, an assessment shall be made to determine whether the surface of the component will provide a strong, bondable surface for the coating material after undergoing proper mechanical cleaning.**

**b. If fibrous glass materials are beyond restoration and deemed unsuitable to support the proper application of a surfacing product or unable to provide a long-term bondable surface, resurfacing shall not be performed.**

**25. Damaged Fibrous Glass Material: When there is evidence of damage, deterioration, delaminating, friable material, such that cleaning or resurfacing cannot restore fibrous glass materials, replacement is recommended. Call to the attention of the Engineer.**

**26. HVAC System Repair: HVAC components found to have pre-existing damage during the cleaning process shall be documented and brought to the attention of the Engineer.**

**27. After return air and exhaust air ducts have been cleaned operate the fan system at full speed for a minimum of 8 hours. Then proceed to cleaning air handler unit and supply air ductwork.**

**28. Allow a one week window scheduled at least 7 days prior with engineer to inspect final cleaning of ducts and fans systems. Systems shall be selected randomly by the engineer. Provide a technician to assist with air handler or duct access. For ductwork cleaning provide photo evidence per reference standard with reference markers as to location showing before and after conditions. If inspection of air handlers at that time is not possible provide photo documentation per referenced standard.**

**29. In the event that engineer does not agree that the fan is clean method 2 from the referenced standard shall be implemented using cleaning and test equipment furnished by the duct cleaning contractor.**

SECTION 23 70 00 - COMMERCIAL PACKAGED ROOFTOP AIR CONDITIONERS

1. Article 1.01: Add new paragraphs B as follows:

**B. This Section applies to AC-1 to AC-7.**

1. Article 2.01, L: Revise and add as follows:

L. Factory-Installed Options: Return Air ~~and/or Supply Air~~ Smoke Detectors ~~Return air and/or supply air smoke detectors can be installed in the unit~~. **with auxiliary contacts for connection by others to fire alarm system.**

1. Article 2.03 through 2.11: Revise, add and re-letter/number as follows:

~~2.03 CABINET, CASING, AND FRAME~~

**I.** Cabinet, Casing and Frame

~~A.~~**1.** Panel construction shall be 18 GA single wall construction with a baked powder coat finish. Insulation shall be a minimum of 3/4" thick fiberglass with a foil face surface. Insulation shall be glued to the panel as well as mechanically fastened. In lieu of foil face insulation with mechanical fasteners, double wall construction may be substituted. Panel design shall not have any exposed insulation edges.

~~B.~~**2.** Exterior surfaces shall be constructed of 18 GA, G90 galvanized, with a baked powder coat finish of a neutral beige color. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

~~C.~~**3.** Base frame shall be 14 GA galvanized steel and be a full perimeter design. The base frame shall have integral forklift slots and rigging holes. The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weather tight seal.

~~D.~~**4.** The full unit base pan shall be a one-piece stamped design. The base pan shall have a stamped 1 1/8” flange around the supply and return air openings to prevent any water to penetrate into the building. The base pan shall be insulated with foil face insulation with mechanical fasteners on the underside of the pan. The rooftop base pan shall not have insulation on the air stream side of the equipment.

~~E.~~**5.** Service doors shall be provided on the filter section, supply fan section and the electrical control panel section. All service access doors shall be mounted on multiple hinges and shall be secured by a 1/4 turn latch system. Removable panels secured by multiple mechanical fasteners are not acceptable.

~~2.04 SUPPLY FAN~~

**J.** Supply Fan

~~A.~~**1.** Supply fan shall be a double width double inlet (DWDI) forward curved centrifugal fan. The supply fan shall be mounted using solid-steel shafts and wheel hubs with mating keyways.

~~B.~~**2.** The fan assembly shall have adjustable pitched sheaves on the motor. Bushings shall be used on all sheaves to allow for easy removal of the pulleys from the fan and motor shaft. Fixed bore pulleys fastened to the shaft by setscrews will not be allowed. The drives shall be selected with a 1.2 service factor.

~~C.~~**3.** All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Bearings shall be sized to provide a L-50 life of 250,000 hours.

~~D~~.**4.** Fan motors shall be heavy-duty, 1800 rpm, open drip-proof (ODP). Motors efficiencies shall meet EPAct efficiencies. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment.

~~E.~~**5.** A factory installed, tested and controlled VFD shall be provided for the supply fan to provide 2 speed supply fan control in accordance with ASHRAE 90.1-2013 Section 6.5. Low speed shall not exceed 66% of full speed and shall be used during periods of low cooling load and ventilation only operation.

~~F.~~**6.** The fan design shall allow for the fan and motor assembly to slide out of the rooftop unit for ease of servicing the equipment.

~~2.05 ELECTRICAL~~

**K.** Electrical:

~~A.~~**1.** Unit wiring shall comply with NEC requirements and with all applicable UL or ETL standards. All electrical components shall be UL or ETL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power connection for main power connection. A terminal board shall be provided for low voltage control wiring. Each compressor and condenser fan motor shall be furnished with contactors and thermal overload protection. Supply fan motors shall have a factory installed and wired control contactor. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

~~B.~~**2.** A single non-fused disconnect switch shall be provided for disconnecting electrical power at the unit. Disconnect switches shall be mounted internally to the control panel and operated by an externally mounted handle.

~~C.~~**3.** A GFI receptacle shall be unit mounted. The receptacle shall require a field power connection independent from the unit’s main power block and / or disconnect.

**4. Provide with factory mounted return air smoke detector. Detector shall include auxiliary contacts for connection by others to the fire alarm system.**

~~2.06 INDOOR COIL SECTION~~

**L.** Indoor Coil Section

~~A.~~**1.** Direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row design. Units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

~~B.~~**2.** A non-corrosive, positively sloped drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall be connected to a threaded drain connection extending through the unit base.

~~C.~~**3.** The rooftop unit shall include a natural gas heating section. The heating module shall be a tubular design with in-shot gas burners. The heat exchanger tubes shall be constructed of 409 stainless steel. The module shall have an induced draft fan that will maintain a negative pressure in the heat exchanger tubes for the removal of the flue gases.

~~D.~~**4.** The heater shall have an electronic direct spark ignition system with a remote flame sensor. The gas furnace shall have a flame rollout safety protection switches and a high temperature limit switch that will shut the gas valve off upon detection of improper burner manifold operation. The induced draft fan shall have an airflow safety switch that will prevent the gas valve from turning on in the event of no airflow in the flue chamber.

~~E.~~**5.** A factory-installed DDC control system shall control the gas heat furnace. The control system shall shut down the entire heating system after two unsuccessful attempts at start-up and require a manual reset. Field installed heating systems shall require a field UL/ETL certification. The manufacturer’s rooftop unit UL/ETL certification shall cover the complete unit including the gas heating modules.

~~2.07 FILTERS~~

**M.** Filers:

~~A.~~**1.** Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” filter. The unit design shall have a hinged access door for the filter section.

~~2.08 OUTDOOR / RETURN AIR SECTION~~

**N.** Outdoor/Return Air Section

~~A.~~**1.** A return air plenum shall be provided with a 0 to 100% outdoor air hood. The hood shall allow outdoor air to enter at the back of the return air plenum. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The return air plenum shall allow return air to enter from the bottom of the unit. The outdoor air damper shall be controlled by a factory installed direct coupled actuator.

~~2.09 OUTDOOR COIL SECTION~~

**O.** Outdoor Coil Section

~~A.~~**1.** Condenser coils shall be multi-row and fabricated from high efficiency rifled copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested with high-pressure air under water.

~~B.~~**2.** Outdoor coil fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm shall be 1140 rpm maximum. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.

~~C.~~**3.** Low ambient cooling shall be allowed to 40 degrees F.

~~D.~~**4.** Refrigeration circuit shall be complete with a thermal expansion valve and liquid line filter drier.

~~E.~~**5.** Refrigerant gauge ports shall be external to the cabinet for both low and high pressure for ease of service.

~~F.~~**6.** Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.

~~G.~~**7.** Each unit shall have two independent refrigeration circuits. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.

~~2.10 ROOF CURB~~

~~A. A prefabricated 14-gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb. Curb shall be seismically rated for the unit.~~

~~2.11 CONTROLS.~~

**P.** Controls

~~A. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, monitoring, unit safety protection, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface.~~

~~B. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. No settings shall be lost, even during extended power shutdowns.~~

~~C. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation. See Control Section for operation of these units from BAS.~~

~~D. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 2 lines x 16 characters. For ease of service, the display format shall be English language readout. The user interaction with the display shall provide the following information as a minimum:~~

~~1. Return air temperature~~

~~2. Supply air temperature~~

~~3. Outdoor air temperature~~

~~4. Space air temp~~

~~5. Dirty filter indication~~

~~6. Airflow verification~~

~~7. Cooling status~~

~~8. Unit status~~

~~9. Last 10 active alarms and / or faults~~

~~E. The user interaction with the keypad shall provide the following setpoints as a minimum:~~

~~1. Controls mode:~~

~~a. Standby~~

~~b. Heat/cool~~

~~c. Cool only~~

~~d. Heat only~~

~~e. Fan only~~

~~2. Occupancy mode~~

~~a. Occupied~~

~~b. Unoccupied~~

~~c. Tenant override~~

~~3. Night setback and setup space temperature~~

~~F. Control system shall have 2 stages for cooling and 2 stages for heating.~~

**A. Units are factory-wired with color-coded wires with all necessary 24-volt electro-mechanical controls. Factory Digital Controls are not acceptable or allowed. See Controls specification for Field Controls.**

## 2.03 roof top unit curbs

**A. For Units 5 Tons and Smaller: A prefabricated seismically rated 12-gauge galvanized steel, mounting curb, designed and manufactured by the unit manufacturer, shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and rail support of the condensing section. Supply and return opening duct frames shall be provided as part of the curb structure allowing duct connections to be made directly to the curb prior to unit arrival. The curb shall be a minimum of 16" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.**

**B. For Units 5 Tons and Larger: Provide with seismically rated non-plenum isolation curb approved by manufacturer for all units.**

**1. Rooftop equipment shall be mounted on an integrated spring and weather seal curb arrangement that fits under the equipment to be isolated and over the curb. Top and bottom members shall be of extruded aluminum and shall be connected by a flexible, water-proof neoprene membrane with counter flashing protection/cover. The aluminum members shall seal against the equipment and against the curb with continuous closed cell neoprene sponge.**

**2. Springs shall be cadmium plated and shall have a deflection as required by drawings with 50% additional travel to solid. Spring diameters shall be no less than 0.8 of the spring height at rated load. Wind resistance shall be provided by means of resilient snubbers in the corners with a minimum clearance of 1/4” so as not to interfere with the spring action except in high winds.**

**3. Curb shall be seismically rated for seismic zone where building is located.**

**4. Submittals shall include spring deflections, spring diameters, compressed spring height and solid spring height, seal material details and the design configuration of the entire base arrangement.**

**5. Vibrex, Thycurb, Amber Booth, Mason, Kinetics Noise Control.**

1. Article 3.01 through 3.06: Add new Part 3 EXECUTION as follows:

## PART 3 - execution

3.01 INSTALLATION

**A. Install and arrange equipment as shown on the Drawings and as recommended by the equipment manufacturer.**

**B. Piping: Refer to applicable sections for piping, ductwork, insulation, painting, etc.**

3.02 ROOF MOUNTED EQUIPMENT INSTALLATION

**A. All roof mounted mechanical equipment shall be supported and seismically anchored on leveled, flashed and counterflashed vibration isolated or non-isolation curbs anchored to resist seismic forces and suitable for the roof construction. Minimum curb height shall be 12" above the roof unless indicated otherwise on the Drawings. Flashing into the roof is specified in another Section.**

**B. Make all piping, electrical and duct penetrations for each piece of equipment within the curb unless shown otherwise on the Drawings. Piping and electrical conduit routed above and across the roof shall be supported on flashed and counterflashed curbs with pipe guides anchored to the curbs in "pitch pockets." Submit shop drawings on other arrangements for approval.**

**C. Acoustical Protection: Install two layers of 5/8" weatherproof sheet rock with staggered joints on the roof deck. Apply sheet rock around all ductwork above the roof and caulk all joints and seams.**

**D. All curbs shall be elevated such that no termination or hole in the roof membrane on the vertical surface is less than 12" above the horizontal.**

3.03 AIR HANDLING INSTALLATION

**A. Installation and Arrangement: Air handling equipment shall be instal­led and arranged as shown on the Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.**

**B. Lubrication: All moving and rotating parts shall be lubricated in accordance with the manufacturer's recommendations prior to start-up.**

**C. Filters: Specified filters or approved temporary construction filters shall be installed in supply units prior to start-up or used for drying and/or temporary heat. See specifications related to ensuring ducts remain clean during construction for more information.**

3.04 SMOKE DETECTOR INSTALLATION

**A. Provide duct-mounted smoke detectors at air handling units in accordance with Code requirements.**

**B. Where detectors are mounted in a concealed location, provide remote indicating panel located as directed.**

**C. Automatic Smoke Detector Fan Shutdown: Coordinate with Automatic Temperature Controls specified elsewhere in these specifications.**

3.05 CONTROLS: see section 23 09 23 and 23 09 93

3.06 START-UP

**A. Manufacturer's Field Service: Once Control Contractor has installed DDC at each unit engage a factory authorized service representative to inspect field assembled components and equipment installation to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the Completed Start-Up Checklists as found in manufacturer's IOM. Do not start unit until both factory technician and DDC technician have approved installation.**

**B. Engage a factory authorized service representative to perform startup service. Start-up shall be scheduled so DDC Contractor is present. Clean entire unit, comb coil fins as necessary, and install clean filters. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.**

**C. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.**

SECTION 23 74 00 - CENTRAL STATION HVAC UNITS

1. Article 2.01, K,2: Remove as follows:

2. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit short circuit protection, 115 volt control circuit transformer and fuse, system switches, and a high temperature sensor. ~~Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection.~~ Supply and return fan motors shall have contactors and external overload protection. Knockouts shall be provided in the of the main control panels for field wiring entrance.

1. Article 2.01, K, 4: Revise as follows:

4. Where unit is a single package combine ~~B~~**1** and ~~C~~**2** to a single point connection.

1. Article 2.01, K, 7: Revise as follows:

7. Single non-fused disconnect ~~swtich~~ **switch** shall be provided for connecting electrical power at the unit. Disconnect switches shall be mounted internal to the control panel and operated by an externally mounted handle. Externally mounted handle is designed to prohibit opening of the control panel door without the use of a service tool.

1. Article 2.01, K, 10: Add new item 10 as follows:

**4. Provide with smoke detector in return air stream path. Detector shall be factory wired to disable fans on smoke sensed at device. Provide device with AUX contacts that allow connection of addressable fire alarm relay. Relay by Division 26.**

1. Article 2.02, D, 4,5: Remove and re-number as follows:

~~4. Provide with smoke detector in return air stream path. Detector shall be factory wired to disable fans on smoke sensed at device. Provide device with AUX contacts that allow connection of addressable fire alarm relay. Relay by Division 26.~~

~~5.~~**4.** All electrical connection components shall be field provided and mounted as shown on project schedule.

1. Article 2.03,I, 3 and 4: Add new items 3 and 4 as follows:

**3. DAH-: Shall operate as an air handler with conventional RA/SA connection through the curb and outside air from the end of the unit ducted to existing outside air louver.**

**4. MAU-1: Shall operate as both a make-up air unit with no return air and an air handler with SA & RA connection through the curb and outside air from the end of the unit with inlet hood and damper. Return air damper is an existing device external to the unit.**

1. Article 2.04, B, 3 and 4: Revise and add as follows:

**3. For Units larger than 10 tons lead compressor on each circuit shall be variable capacity with digital operation or with VFD operation.**

**4. Units shall contain a minimum of 2 refrigerant circuits.**

1. Article 3.02, A: Revise as follows:

A. All roof mounted mechanical equipment shall be supported and seismically anchored on leveled, flashed and counterflashed vibration isolated **or non-isolated (for MAU-1 & DAH-1)** curbs anchored to resist seismic forces and suitable for the roof construction. Minimum curb height shall be 12" above the roof unless indicated otherwise on the Drawings. Flashing into the roof is specified in another Section.

1. Article 3.02, D: Revise as follows:

D. Install on vibration isolation curbs ~~where noted on drawings~~ **unless noted otherwise**.

1. Article 3.05, B: Revise as follows

**B. For integrated systems the manufacture shall provide a trained representative to review the sequence of operations with the control contractor. The factory control system point integration document shall be annotated by factory representative and control contractor at each instance where the BAS and integrated controller share information.**

1. Article 3.07: Add new article as follows:

3.07 RESTORATION OF EXISTING HVAC EQUIPMENT

**A. General: Where restoration or other type of work is indicated, include the following as minimum required work. See section C for more details.**

**1. Replace motors as noted, belts (matched set on multiple belt systems), sheaves, and bearings. Motors shall be per 23 05 00 with shaft grounding at VFD driven motors. Belts and sheaves per 23 05 00. Replace backdraft dampers not integral to exhaust fans.**

**2. Bearings shall be manufactured by SKF, Fafnir or Dodge. Provide submittal. Bearings shall have zone harden path for bearing surface and 120º set screws. Do not use eccentric collar bearings. Provide with new housing (pillow block, side casing flange) etc. Match bearing housing style currently installed. Prior to any replacement work at air handlers complete a vibration analysis of fan, drive, bearing and shaft. Firm completing the analysis shall specialize in this service. (OTS Precision Balancing or approved). Technician completing the bearing replacement shall specialize in this service. If after the bearing replacement is complete fan operation is noisy, or vibrates to a level determined by Engineer to be unacceptable, replacement of all rotating devices shall be at the Contractors expense.**

**3. Replace flex connectors and supply and return, OSA, relief duct connections.**

**4. Replace magnetic starter(s) and overload protective devices. See Section 23 05 00 for VFD or starter. See drawings for where VFD’s are required.**

**5. Replace filters media. See Section 23 40 00.**

**6. Where missing, provide filter close off panels to bridge the gap between air handler wall and nominal filter sizes. Close off panels shall be no wider than 2".**

**7. Clean unit casing(s), plenum(s), fan scroll(s) and damper blades.**

**8. Vacuum clean entire air handler enclosure.**

**9. At air handlers clean fan wheels from low pressure and high pressure side with same method as coil above. Ensure fans are installed correctly if removed for cleaning.**

**10. Clean damper surfaces and adjust linkage to ensure dampers close/open properly.**

**11. Clean existing return air ductwork re-used, see Section 23 30 00 for more information.**

**DRAWINGS**

**Mechanical:**

1. Sheets DM1.1-DM1.3:
   1. Added a note for (e)MZU-5, 7 & 13 to remove (e) exhaust louver and plenum for replacement.
   2. Added reference to keyed note.
   3. Modified note for (e)OSA duct;
2. Sheet DM1.5:
   1. Added a note to remove & replace (e) exhaust fan and ductwork.
3. Sheet DM1.6:
   1. Added a note to replace (e) ductwork in locker rooms due to structural work.
4. DM1.7 was a duplicate of DM1.6. DM1.8 became DM1.7.
5. Sheets M1.1-M1.3:
   1. Changed air handling unit mark from AHU-1 , AHU-2 & AHU-3 to AHU-5, AHU-7 & AHU-13;
   2. Added a note to replace (e) exhaust louver and plenum for new air handling units replacement.
   3. Added VFD location on the plans.
   4. Added existing airflow to classrooms S-4 and S-2.
   5. Added a note to replace (e) boilers controllers.
6. Sheet M1.5:
   1. Added a note to remove and replace (e) exhaust fan and associated ductwork.
7. Sheet M1.6:
   1. Added a note to remove & replace (e) ductwork in locker rooms due to structural work.
8. Sheet M2.3 & M2.6:
   1. Added keyed notes to AC-4, 5, 6 & 7.
   2. Change the key notes from 2 to 3 for big gym (e) relief head.
9. Sheet M2.1 & M2.4:
10. Changed the AHU-1, AHU-2 & AHU-3 mark numbers to AHU-5, AHU-7 & AHU-13.
11. Sheet M2.5:
    1. Key note #1 was added.
    2. Modified note for CU-1-CU-6 ;
12. Sheets M6.0:
    1. Deleted separate schedule for DAC-1.
    2. Deleted vibration isolation curb for DAH-1.
13. Sheets M6.1 & M6.3:
    1. Changed the air handling units mark from AHU-1, AHU-2 & AHU-3 to AHU-5, AHU-7 & AHU-13.
    2. Modified heating coil parameters.
    3. Modified general notes for air handling units.
14. Sheet M6.4:
    1. Details 4 and 5 are modified.
15. Sheet M6.5:
    1. Details 1, 3, 4 & 6 are modified.
16. Sheet M6.6:
    1. Details 1, 2 & 5 are modified.

**Mechanical 8.5x11 drawings**

**Plumbing Drawings**

1. Sheets P-1.1 thru P-1.3:
   1. Revised piping per Pre-Bid Walk thru
   2. Added shut-off valves as directed
   3. Coordinated detail call-outs
   4. Edited Plan Notes D & F

1. Sheet P6.1:
   1. Edited S-1 in Plumbing Connection Schedule
   2. Modified detail 10/P6.1
   3. Removed un-used detail 9/P6.1

**Fire Protection Drawings**

1. Sheet FP-1.1:
   1. Increased text size on the sheet
   2. Change scale to NOT TO SCALE

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