SECTION 238119 - SELF-CONTAINED AIR-CONDITIONERS

This Section includes requirements for sustainable design systems. However, equipment specified in this Section may not meet requirements of those systems. Verify, with manufacturers, that the requirements can be met. To comply, HVAC system design alternatives that do not include self-contained air-conditioners may be required.

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes packaged, **[air] [water]**-cooled air-conditioning units with refrigerant compressors and controls intended for indoor installations.
			2. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
				2. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for self-contained air-conditioners.

Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

* + - * 1. Sustainable design submittals.
				2. Shop Drawings:

Include plans, elevations, sections, and **[mounting] [attachment]** details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

Include diagrams for power, signal, and control wiring.

* + - * 1. Samples for Initial Selection: For units with factory-applied color finishes.

Retain "Coordination Drawings" paragraph below for situations where limited space necessitates maximum utilization for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. Coordination Drawings: Detail self-contained air-conditioners and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

Structural members to which self-contained air-conditioners will be attached.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for self-contained air-conditioners, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For self-contained air-conditioners to include in emergency, operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Filters: **[One] <Insert number>** set(s) of filters for each unit.

Fan Belts: [One] **<Insert number>** set(s) of belts for each unit.

Gaskets: [**One] <Insert number>** set(s) for each access door.

Fuses: **[One] <Insert number>** set(s) for each air conditioning unit.

* + - 1. QUALITY ASSURANCE

Retain "Testing Agency Qualifications" paragraph below to require a UL, a CE, or an ETL marking.

* + - * 1. Testing Agency Qualifications: An NRTL.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Comply with self-contained air-conditioner manufacturer's written instructions for handling.
			2. WARRANTY

When warranties are required, verify with Director’s Representative 's that special warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of self-contained air-conditioners that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components.

Warranty Period:

Retain the applicable level of warranty in three subparagraphs below. Flexibility exists in the level of warranty that can be purchased; not all manufacturers' standard warranties are the same and differences add/subtract base unit cost. Extended warranties will affect construction costs.

For Compressor: **[One] [Five] <Insert number>** year(s) from date of Substantial Completion.

For Parts: **[One] [Five] <Insert number>** year(s) from date of Substantial Completion.

For Labor: **[One] [Five] <Insert number>** year(s) from date of Substantial Completion.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. ASHRAE Compliance:

Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

"ASHRAE Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require compliance with requirements in ASHRAE 62.1. Besides establishing minimum ventilation rates, ASHRAE 62.1 includes requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain pan construction and connection, finned-tube coil selection and cleaning, and equipment access. Verify, with manufacturers, availability of units with components and features that comply with these requirements.

ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

"ASHRAE/IES Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. Sustainable design systems require minimum efficiency equal to requirements in ASHRAE/IES 90.1.

* + - * 1. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. Seismic Performance: Self-contained air-conditioners shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7] <Insert requirement>**.

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified**[ and the unit will be fully operational after the seismic event]**."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: **[1.5] [1.0]**.

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table, for requirements to be inserted in subparagraph below.

**<Insert requirements for Component Amplification Factor and Component Response Modification Factor>**.

* + - 1. CAPACITIES AND CHARACTERISTICS

If Project has more than one type or configuration of self-contained air-conditioner, delete this article and schedule self-contained air-conditioners on Drawings.

* + - * 1. Cooling Capacity:

Total: **<Insert number>** Btu/h.

Sensible: **<Insert number>** Btu/h.

Retain first subparagraph below for units with cooling capacity of 5 tons or less.

Seasonal Energy-Efficiency Ratio: **[10.0] [12.0] [13.0] [14.0] [16.0] <Insert ratio>**.

Retain first subparagraph below for units with cooling capacity of more than 5 tons.

Energy-Efficiency Ratio: **[10.0] [12.0] [13.0] [14.0] [16.0] <Insert ratio>**.

Entering-Air Temperature:

Dry Bulb: **<Insert number>** deg F.

Wet Bulb: **<Insert number>** deg F.

Leaving-Air Temperature:

Dry Bulb: **<Insert number>** deg F.

Wet Bulb: **<Insert number>** deg F.

* + - * 1. Heating Capacity:

Total: **<Insert number>** Btu/h.

Air-Temperature Rise: **<Insert number>** deg F.

Airflow:

High: **<Insert number>** cfm.

Low: **<Insert number>** cfm.

Hot Water:

Entering-Water Temperature: **<Insert number>** deg F.

Leaving-Water Temperature: **<Insert number>** deg F.

Water Flow: **<Insert number>** gpm.

Water Pressure Drop: **<Insert number>** feet of head.

Electric Heat:

Total Capacity: **<Insert number>** Btu/h.

Air-Temperature Rise: **<Insert number>** deg F.

Control Steps: **[One] [Two] [Three] <Insert number>**.

* + - * 1. Supply-Air Fan:

Size: **<Insert number>** hp.

Total Airflow:

Retain first two subparagraphs below for variable-speed fans.

High: **<Insert number>** cfm.

Low: **<Insert number>** cfm.

Outdoor Airflow: **<Insert number>** cfm.

* + - * 1. Air-Cooled Condenser:

Number of Fans: **[Two] [Four] <Insert number>**.

Motor Speed: **<Insert value>** rpm.

Motor Horsepower (Watts): **<Insert number>** hp.

Ambient Temperature: **<Insert number>** deg F.

* + - * 1. Water-Cooled Condenser:

Entering-Water Temperature: **<Insert number>** deg F.

Leaving-Water Temperature: **<Insert number>** deg F.

Water Flow: **<Insert number>** gpm.

Water Pressure Drop: **<Insert number>** feet of head.

If unit includes air-side energy recovery between exhaust and outside air, copy information in "Filters" paragraph below to schedule that filter.

* + - * 1. Filters:

Type: **<Insert type>**.

Face Dimensions, each: **<Insert number>** inches by inches.

Depth: **<Insert number>** inches.

Numbers of Filters, Wide by High: **<Insert number>**.

Maximum or Rated Face Velocity: **<Insert number>** fpm.

Initial Resistance: **<Insert number>** inches wg.

Recommended Final Resistance: **<Insert number>**inches wg.

Retain "Minimum Efficiency Reporting Value and Average Arrestance" subparagraph below if requiring MERV 4 or lower. Retain "Minimum Efficiency Reporting Value" subparagraph if inserting requirements for MERV 5 and higher. LEED 2009 IEQ Prerequisite 1 and LEED v4 EQ Prerequisite "Minimum Indoor Air Quality Performance" require compliance with ASHRAE 62.1 (2007 and 2010 versions, respectively), which require a MERV rating of 6 or higher for service to occupied spaces. LEED 2009 IEQ Credit 5 and LEED v4 EQ Credit "Enhanced Indoor Air Quality Strategies" require MERV 13 or higher. Insert values appropriate to Project sustainability goals.

Minimum Efficiency Reporting Value and Average Arrestance:

MERV Rating: **[MERV 4] <Insert value>**, and corresponding average arrestance according to ASHRAE 52.2.

Minimum Efficiency Reporting Value:

MERV Rating: **[MERV 6] [MERV 13] <Insert value>**, according to ASHRAE 52.2.

* + - * 1. Accessories:

Manual outdoor-air damper.

Motorized outdoor-air damper.

Air-side economizer.

Water-side economizer.

ASHRAE/IES 90.1-2016 prohibits hot-gas bypass unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot-gas bypass is also limited to 15 percent of total capacity for VAV units less than or equal to 240,000 Btu/h and to 10 percent of total capacity for VAV units greater than 240,000 Btu/h. Hot-gas bypass is prohibited on constant volume units.

Hot-gas bypass.

Retain subparagraph below for units larger than 15 tons.

Air Pressure Switch: Indicates when differential pressure exceeds set point representing dirty filters.

* + - * 1. Single-Point Electrical Characteristics:

Volts: **[120] [208] [230] [460] <Insert number>** V.

Phase: **[Single] [Three]**.

Hertz: 60 Hz.

Full-Load Amperes: **<Insert number>** A.

Minimum Circuit Ampacity: **<Insert number>** A.

Maximum Overcurrent Protection: **<Insert number>** A.

* + - 1. MANUFACTURERS
				1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Bard Manufacturing Company.

Carrier Global Corporation.

Daikin Applied.

Engineered Air.

Trane Inc.

Approved equivalent.

* + - 1. PACKAGED UNITS
				1. Description: Factory assembled, wired, and tested; and fully charged with refrigerant and oil.

Retain one of three "Configuration" paragraphs below.

* + - * 1. Configuration: Horizontal, ceiling**[-plenum]** mounted.
				2. Configuration: Vertical, floor mounted; **[vertical] [and] [horizontal]** discharge.
				3. Configuration: Horizontal, ceiling mounted and vertical, floor mounted; **[vertical] [and] [horizontal]** discharge.
				4. Disconnect Switch: Factory mounted **[in control panel] [on cabinet]**.
			1. CABINET
				1. Frame and Panels: Structural-steel frame with galvanized-steel panels and access doors or panels.

Retain first subparagraph below if units are exposed in finished spaces.

Exterior-Surface Finish: Factory painted in color selected by Architect.

ASHRAE compliance in "Interior-Surface Finish" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

Interior-Surface Finish: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Insulation options vary widely across manufacturers. A few manufacturers offer double-wall foam-insulated or double-wall fiberglass-insulated cabinets in 1- or 2-inch thickness. One manufacturer also offers an additional 2 inches of fiberglass insulation in conjunction with the foam insulation for better acoustics. Retain or insert insulation options available by manufacturers; consult manufacturers.

* + - * 1. Insulation: **[1-inch- thick, glass-fiber duct liner complying with ASTM C1091 and having a microbial coating on cabinet interior and control panel.] <Insert insulation thickness and type>**.
				2. Return-Air Opening: Rear, **[open] [flange for duct connection]**.

Corrosion-resistant coating options are not available from all manufacturers; consult manufacturers.

* + - * 1. Corrosion-Resistant Treatment: **[None] [Phenolic coating on unit interior and exterior] <Insert coating type and casing location>**.
			1. SUPPLY-AIR FAN
				1. Fan Material: Galvanized steel.

For units 15 tons (50 kW) and smaller, "forward-curved" option in "Configuration" paragraph below may be the only fan choice. Consult manufacturers.

* + - * 1. Configuration: Double-width, double-inlet, **[forward-curved] [airfoil]** centrifugal fan; statically and dynamically balanced. **[Vertical] [Horizontal]** discharge with flexible discharge collar.

In "Drive" paragraph below, options vary with capacity and manufacturer. Consult manufacturers.

* + - * 1. Drive: **[Belt] [, with permanently lubricated bearings] [, with greaseable bearings] [Direct, with fan and motor resiliently mounted]**.

In "Motor Type" paragraph below, options vary with manufacturer. Consult manufacturers.

* + - * 1. Motor Type: **[Multispeed, permanent split case] [Open-dripproof] [Totally enclosed fan-cooled] [Electronically commutated variable speed] <Insert type>** type.

Retain first three paragraphs below for belt-driven units.

* + - * 1. Motor Sheave: **[Fixed] [Variable and adjustable]** pitch, dynamically balanced, and selected to achieve specified rpm when set at midposition.
				2. Fan Sheaves: **[Variable] [Fixed]** pitch, dynamically balanced, bored to fit shafts, and keyed for initial startup.
				3. Belt Rating: As recommended by manufacturer or a minimum of one and one-half times nameplate rating of motor.
				4. Bearings: Grease lubricated with grease lines extended to exterior of unit**[ with L-50 life at 200,000 hours] <Insert life rating and hours>**.

Retain one of two "Variable-Frequency Motor Controller" paragraphs below. First paragraph coordinates with electrical variable-frequency motor-control specification. Second paragraph describes basic features of variable-frequency motor controllers and can be used when variable-frequency motor controller is not on a schedule on Drawings or is different from that specified in variable-frequency motor-controller specification. Coordinate either option with electrical engineer and manufacturers.

* + - * 1. Variable-Frequency Motor Controller: Comply with Section 262923 "Variable-Frequency Motor Controllers."

"Variable-Frequency Motor Controller" paragraph below is an example of variable-frequency controllers. Retain features and attributes to suit Project, and verify their availability with manufacturers.

* + - * 1. Variable-Frequency Motor Controller: Serving each fan.

Manufactured Units: Pulse-width modulated; **[constant torque] [and] [variable torque] <Insert application>** for **[Design A and Design B] [inverter-duty]** motors.

Output Rating: Three phase; 10 to **[60 Hz, with voltage proportional to frequency throughout voltage range] [66 Hz, with torque constant as speed changes]**; maximum voltage equals input voltage.

Unit Operating Requirements:

Internal Adjustability:

Minimum Speed: 5 to 25 percent of maximum rpm.

Maximum Speed: 80 to 100 percent of maximum rpm.

Acceleration: **[0.1 to 999.9] <Insert range>** seconds.

Deceleration: **[0.1 to 999.9] <Insert range>** seconds.

Current Limit: 30 to minimum of 150 percent of maximum rating.

Self-Protection and Reliability Features:

Surge suppression.

Loss of input signal protections.

Under- and overvoltage trips.

Variable-frequency motor controller and motor-overload/overtemperature protection.

Critical frequency rejection.

Loss-of-phase protection.

Reverse-phase protection.

Motor-overtemperature fault.

Bidirectional autospeed search.

Torque boost.

Motor temperature compensation at slow speeds.

Panel-mounted operator station.

Historical logging information and displays.

Digital indicating devices.

Control Signal Interface: Electric.

Proportional Integral Derivative control interface.

DDC system for HVAC Protocols for Network Communications: **[ASHRAE 135] <Insert protocol type>**.

Line Conditioning:

Input line conditioning.

Output filtering.

EMI/RFI filtering.

Bypass is not available from all manufacturers; consult manufacturers.

Bypass Systems:

Bypass Mode: **[Manual operation only] [Field-selectable automatic or manual]**.

Retain one of two "Bypass Controller" subparagraphs below. Bypass is not available from all manufacturers; consult manufacturers.

Bypass Controller: Two-contactor style, with bypass and output isolating contactors**[ and isolating switch]**.

Bypass Controller: Three-contactor style, with bypass and input and output isolating contactors**[ and isolating switch]**.

Bypass Contactor Configuration: **[Full-voltage (across the line)] [Reduced-voltage (autotransformer)] <Insert type>** type.

Default motor characteristics are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Special Motor Features: Premium efficiency, as defined in Section 230513 "Common Motor Requirements for HVAC Equipment."

If unique characteristics are required for motors in this Section, insert in subparagraph below.

**<Insert unique motor characteristics>**.

Retain "Isolation" paragraph below for units larger than 15 tons.

* + - * 1. Isolation: Mount fan and motor on common subbase and mount assembly on spring isolators with minimum static deflection of **[1 inch] <Insert deflection>**.

In "Outdoor-Air-Intake Accessories" paragraph, not all options are available from all manufacturers. Consult manufacturers.

* + - * 1. Outdoor-Air-Intake Accessories:

Barometric Outdoor-Air Damper: Adjustable-blade damper allowing induction of up to 25 percent outdoor air when evaporator fan is running.

Motorized Outdoor-Air Damper: Motorized, two-position blade damper allowing induction of up to 25 percent outdoor air; with spring-return, low-voltage damper motor.

Energy-Recovery Ventilator: Assembly of desiccant-coated, heat-recovery wheels and centrifugal exhaust fans to transfer approximately **[67] <Insert number>** percent of the difference between the sensible and latent heat of outdoor and exhaust air; with **<Insert type and depth>** filter on outside-air inlet side to keep ventilator clean.

Air-Side Economizer: Damper assembly allowing induction of up to 100 percent outdoor air to maintain a selected mixed-air temperature; and exhaust damper and spring-return, low-voltage, modulating damper motor with minimum position adjustment.

* + - 1. REFRIGERATION SYSTEM
				1. Compressor: Scroll type, hermetically sealed, 3600 rpm maximum, and resiliently mounted with positive lubrication and internal motor protection.
				2. Refrigerant Coils**[ Indoor and Outdoor for Air-Cooled Units]**: Seamless copper tubes expanded into aluminum fins.

Corrosion-resistant treatment in "Coating" subparagraph below is an optional feature.

Coating: **[None] [Corrosion resistant]**.

Retain options in 'Refrigerant Circuits" subparagraph below for units larger than 15 tons.

Refrigerant Circuits: A separate circuit for each compressor, with externally equalized thermal-expansion valve**[ with adjustable superheat]**, filter dryer,**[ sight glass, high-pressure relief valve,]** and charging valves.

ASHRAE compliance option in first subparagraph below may be required to comply with Project requirements or authorities having jurisdiction and is required for sustainable design systems.

Mount coil assembly over sloped, stainless-steel drain pan**[ complying with ASHRAE 62.1] [and] [having a condensate pump unit with integral float switch, pump-motor assembly, and condensate reservoir]**.

Refrigerant: **[R-407C] [or] [R-410A]**.

Refrigerant dryer.

High-pressure switch.

Low-pressure switch.

Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.

Low ambient temperature switch.

Brass service valves installed in discharge and liquid lines.

* + - * 1. Water-Cooled Condenser:

Description: Factory assembled and tested; tube-in-tube coaxial type with water-regulating valve.

Not all manufacturers offer each option listed in "Tubing" subparagraph below; consult manufacturers.

Tubing: **[Nonferrous] [Copper] [Cupronickel] [Steel]** inner tube.

Coating: **[None] [Corrosion resistant]**.

Retain "Water-Side Economizer Section" paragraph below if desired for water-cooled units.

* + - * 1. Water-Side Economizer Section:

Description: Factory assembled and tested; consisting of water coil, modulating valves, controls, piping with cleanouts, and access panels.

Water Coil: **[Two] [Four]** rows, copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and **[copper] [cast-iron]** headers; having a two-position control valve.

* + - 1. HEATING COIL

Retain "Water Coil" or "Electric Coil" paragraph below if unit includes heating.

* + - * 1. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; having a two-position control valve.
				2. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow-proving device; and one-time fuses in terminal box for overcurrent protection.
			1. CONTROLS
				1. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."

Retain one of first two "Control Package" paragraphs below. Individual manufacturers offer specific control features. Not all manufacturers offer all features; consult manufacturers.

* + - * 1. Control Package: Factory wired, including contactor, high- and low-pressure cutouts, internal-winding thermostat for compressor, control-circuit transformer, and noncycling reset relay.

System Selector Switch: **[Heat-off-cool] [Off-heat-auto-cool]**.

Revise "Adjustable Thermostat" subparagraph below to suit unit configuration.

Adjustable Thermostat: **[Unit mounted] [Remote]** to control the following:

Supply fan.

Compressor.

Condenser.

Hot-water coil valve.

Electric heater.

Time-Delay Relay: Delay in starting lag compressor to prevent power demand surges.

Antirecycle Timer: Locks out the compressor for an interval of time to prevent rapid starting and stopping.

* + - * 1. Control Package:

Microprocessor Control Panel: Controls unit functions as **[standalone] [full BAS communication via BACnet MS/TP] [full BAS communication via BACnet/IP] [full BAS communication via LON] [full BAS communication via MODBUS]**, including refrigeration and safety controls, with unit-mounted display, and the following:

Revise subparagraphs below to suit unit configuration.

Supply fan.

Supply-fan motor speed.

Compressors.

Air-cooled condenser.

Cooling tower pump.

Modulating, hot-water coil valve.

Multistep, electric heater.

Time-of-day control to cycle unit on and off.

Night-heat, morning warm-up cycle.

Economizer control.

Panel-mounted control switch to operate unit in remote or local control mode or to stop or reset.

Panel-mounted indication of the following:

Operating status.

System diagnostics and safety alarms.

Supply-air temperature set point.

Zone heating-temperature set point.

Supply-air pressure set point.

Economizer minimum position set point.

Supply-air-pressure, high-limit set point.

* + - 1. MATERIALS
				1. Steel:

ASTM A36 for carbon structural steel.

ASTM A568 for steel sheet.

* + - * 1. Stainless Steel:

Manufacturer's standard grade for casing.

Manufacturer's standard type, ASTM A240 for bare steel exposed to airstream or moisture.

* + - * 1. Galvanized Steel: ASTM A653.
				2. Aluminum: ASTM B209.

Retain first paragraph below if corrosion-resistant coating is specified in Section 230546 "Coatings for HVAC."

* + - * 1. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

Retain "Corrosion-Resistant Coating" paragraph below if corrosion-resistant coating options are cited in "Refrigerant Coils" or "Water-Cooled Condenser" paragraph in "Source Quality Control" Article and if corrosion-resistant coating is specified in this Section. Determine availability with air-conditioner manufacturers.

* + - * 1. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a **[3000] <Insert time>**-hour salt-spray test according to ASTM B117.

Standards:

ASTM B117 for salt spray.

ASTM D2794 for minimum impact resistance of 100 in-lb.

ASTM B3359 for cross-hatch adhesion of 5B.

Application: **[Immersion] [Spray]**.

Thickness: **[1 mil] <Insert value>**.

Gloss: Minimum gloss of 60 on a 60-degree meter.

* + - 1. SOURCE QUALITY CONTROL
				1. AHRI Compliance:

Retain one or more of three subparagraphs below depending on types of units in Project. Retain first subparagraph for units with cooling capacity less than 65,000 Btu/h; retain second for units with cooling capacity from 65,000 to 250,000 Btu/h; retain third for vertical configuration in a commercial or industrial application. Not all manufacturers offer AHRI certification; consult manufacturers.

AHRI 210/240 Certification: Units and their components shall be factory tested according to AHRI 210/240 and shall be listed and labeled by AHRI.

AHRI 340/360 Certification: Units and their components shall be factory tested according to AHRI 340/360 and shall be listed and labeled by AHRI.

AHRI 390 Certification: Units and their components shall be factory tested according to AHRI 390 and shall be listed and labeled by AHRI.

* + - * 1. ETL listed.
				2. Water Coils: Factory tested to minimum 300-psig internal pressure while underwater according to AHRI 410 and ASHRAE 33.
				3. Refrigerant Coils: Factory tested to minimum 450-psig internal pressure and to minimum 300-psig internal pressure while underwater, according to AHRI 410 and ASHRAE 33.
				4. Water-Cooled Condenser: Refrigerant and water side factory tested to minimum 400-psig internal pressure while underwater.
				5. Water-Side Economizer: Factory tested to minimum 300-psig internal pressure while underwater.
1. EXECUTION
	* + 1. INSTALLATION
				1. Equipment Mounting:

Retain first two subparagraphs below to require equipment to be installed on cast-in-place concrete equipment bases.

Install air-handling units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device types and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548.13 "Vibration Controls for HVAC."

* + - * 1. Suspended Units: Suspend**[ and brace]** units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in **[Section 230548 "Vibration and Seismic Controls for HVAC."] [Section 230548.13 "Vibration Controls for HVAC."]**
				2. Arrange installation of units to provide access space around units for service and maintenance.
				3. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

Coordinate duct installations and specialty arrangements with Drawings and with requirements specified in Section 233113 "Metal Ducts" and Section 233300 "Air Duct Accessories."

* + - * 1. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

Retain "Duct Connections" paragraph below for units connected to ducts. Coordinate duct installation requirements with Drawings and with requirements specified for duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply**[ and return]** ducts to self-contained air-conditioners with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."
			1. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Connect condensate drain pans using **[NPS 1-1/4] <Insert pipe size>**, ASTM B88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

Retain "Hot-Water Coil Connections" paragraph below for units with hot-water coils.

* + - * 1. Hot-Water Coil Connections: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Connect to supply and return coil with shutoff-duty valve and union or flange on the supply connection, and with throttling-duty valve and union or flange on the return connection.
				2. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

Retain "Water-Cooled Condenser Connections" paragraph below for units with water-cooled condenser.

* + - * 1. Water-Cooled Condenser Connections: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Connect to supply and return with shutoff-duty valve and union or flange on the supply connection, and with throttling-duty valve and union or flange on the return connection.
				2. Where installing piping adjacent to equipment, allow space for service and maintenance.
				3. Connect piping to units mounted on vibration isolators with flexible connectors.
			1. ELECTRICAL CONNECTIONS
				1. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
				2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
				3. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
				4. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

Retain one or two subparagraphs below. First subparagraph cross-references Section 260553 "Identification for Electrical Systems" and should be retained for consistent electrical identification. Second is an abbreviated version of the product specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

* + - 1. CONTROL CONNECTIONS
				1. Install control and electrical power wiring to field-mounted control devices.
				2. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
			2. FIELD QUALITY CONTROL

Retain one of two paragraphs below.

Retain "Testing Agency" paragraph below to require Contractor to hire an independent testing agency.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a factory-authorized service agent.

* + - * 1. Perform the following tests and inspections**[ with the assistance of a Company Field Advisor per OGS Spec Section 014216]**:

Charge refrigerant coils with refrigerant and test for leaks.

Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

* + - * 1. Units will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. STARTUP SERVICE
				1. **[Engage a Company Field Advisor per OGS Spec Section 014216 to perform] [Perform]** startup service.
			2. ADJUSTING
				1. Adjust damper linkages for proper damper operation.
				2. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing unit.
			3. CLEANING
				1. After completing system installation and testing, adjusting, and balancing unit and after completing startup service, clean units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings; install new, clean filters.
			4. DEMONSTRATION
				1. **[Engage a Company Field Advisor per OGS Spec Section 014216 to train] [Train]** Facility’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238119