SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

This Section may include provisions for LEED 2009, LEED v4, ASHRAE 189.1, IgCC, and Green Globes. Note that some sustainable design requirements are either mandatory or optional requirements that may be inserted in the Section Text using the hypertext links. Other requirements that are associated with sustainable design, and may be considered "best practice" or retained even if a sustainable design standard is not a project requirement, are discussed in the Evaluations. Verify, with manufacturers, that the requirements for prerequisites and credits can be met. To achieve prerequisites and obtain credits, HVAC system design alternatives that do not include split-system 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 split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.
      2. 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 indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
         5. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Retain subparagraph below if equipment includes wiring.

Wiring Diagrams: For power, signal, and control wiring.

* + - * 1. Samples for Initial Selection: For units with factory-applied color finishes.
        2. Field quality-control reports.
        3. Warranty: Sample of special warranty.
      1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For split-system air-conditioning units 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) for each air-handling unit.

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

Fan Belts: **[One] <Insert number>** set(s) for each air-handling unit fan.

* + - 1. QUALITY ASSURANCE
         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" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED 2009 Prerequisite IEQ 1and LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance 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. See "Sustainable Design Considerations" Article in the Evaluations for discussion on this prerequisite. 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 - " Procedures," and Section 7 - "Construction and System Start-up."

"ASHRAE/IES Compliance" paragraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED 2009 Prerequisite EA 2 and LEED v4 EA Prerequisite Minimum Energy Performance require minimum efficiency equal to requirements in ASHRAE/IES 90.1. See "Sustainable Design Considerations" Article in the Evaluations for discussion on this prerequisite.

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

Retain first paragraph below if remote condensing units are located on grade; retain second paragraph if they are located on roof.

* + - * 1. 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."
        2. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
      1. WARRANTY

When warranties are required, verify with Director’s Representative's counsel 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's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2.

Warranty Period:

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. 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:

Carrier Global Corporation.

Coleman Company Inc. (The).

Friedrich Air Conditioning Company.

Lennox Industries, Inc.; Lennox International.

Mitsubishi Electric & Electronics USA, Inc.

Samsung HVAC.

SANYO North America Corporation.

Trane.

YORK; brand of Johnson Controls International plc, Building Solutions North America.

Approved equivalent.

* + - 1. INDOOR UNITS (5 TONS OR LESS)
         1. Concealed Evaporator-Fan Components:

Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

Insulation: Faced, glass-fiber duct liner.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

Retain one of first two subparagraphs below if heating coil is required.

Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

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.

Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

Fan Motors:

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

Multitapped, multispeed with internal thermal protection and permanent lubrication.

Wiring Terminations: Connect motor to chassis wiring with plug connection.

Retain "Airstream Surfaces" subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, or as required by authorities having jurisdiction. See "Sustainable Design Considerations" Article in the Evaluations for discussion.

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Filters: Permanent, cleanable.

Condensate Drain Pans:

First option in first subparagraph below is minimum slope in ASHRAE 62.1.

Fabricated with **[one] [two]** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

ASHRAE compliance option in "Length" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first option in first subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, and as required by authorities having jurisdiction; otherwise, insert distance.

Length: Extend drain pan downstream from leaving face **[to comply with ASHRAE 62.1] <Insert distance>**.

Depth: A minimum of **[2 inches] <Insert depth>** deep.

Retain one of first two subparagraphs below. Retain second subparagraph if drain-pan temperature is expected to fall below surrounding dew point temperature.

Single-wall, **[galvanized] [stainless]**-steel sheet.

Double-wall, **[galvanized] [stainless]**-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

Minimum Connection Size: **[NPS 1] [NPS 2] <Insert size>**.

Retain first subparagraph below for galvanized-steel drain pans; delete for stainless-steel drain pans.

Pan-Top Surface Coating: Asphaltic waterproofing compound.

Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

* + - * 1. Floor-Mounted, Evaporator-Fan Components:

Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.

Discharge Grille: **[Steel with surface-mounted frame] [Welded steel bars forming a linear grille and welded into supporting panel]**.

Insulation: Faced, glass-fiber duct liner.

Drain Pans: Galvanized steel, with connection for drain; insulated.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

Retain one of first two subparagraphs below if heating coil is required.

Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

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.

Fan: Direct drive, centrifugal**[, with power-induced outside air]**.

Fan Motors:

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

Multitapped, multispeed with internal thermal protection and permanent lubrication.

Air Filtration Section:

See Evaluations for discussion on filter characteristics and applications. LEED Prerequisite IEQ 1 and LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher.

General Requirements for Air Filtration Section:

Comply with NFPA 90A.

Minimum MERV according to ASHRAE 52.2.

Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

Disposable Panel Filters:

Retain one or more of first six subparagraphs below, as applicable. If Project has more than one filter type, indicate filter type for each unit on Drawings.

Factory-fabricated, viscous-coated, flat-panel type.

Thickness: **[1 inch] [2 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[5] <Insert value>**.

Media: Interlaced glass fibers sprayed with nonflammable adhesive**[ and antimicrobial agent]**.

Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

Extended-Surface, Disposable Panel Filters:

Factory-fabricated, dry, extended-surface type.

Thickness: **[1 inch] [2 inches] [4 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[7] <Insert value>**.

Media: Fibrous material formed into deep-V-shaped pleats**[ with antimicrobial agent]** and held by self-supporting wire grid.

Media-Grid Frame: **[Nonflammable cardboard] [Galvanized steel] [Fire-retardant, 3/4-inch particleboard with gaskets]**.

Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

* + - * 1. Wall-Mounted, Evaporator-Fan Components:

Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

Retain "Electric Coil" subparagraph below for heat-pump units and supplemental electric heat.

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.

Fan: Direct drive, centrifugal.

Fan Motors:

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

Multitapped, multispeed with internal thermal protection and permanent lubrication.

Retain first subparagraph below if enclosure is not open-dripproof type. Retain second subparagraph for premium efficiency.

Enclosure Type: Totally enclosed, fan cooled.

NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

Retain first subparagraph below to require that disconnect switches be supplied with unit.

Mount unit-mounted disconnect switches on **[exterior] [interior]** of unit.

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

**<Insert unique motor characteristics>**.

Retain "Airstream Surfaces" subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, or as required by authorities having jurisdiction. See "Sustainable Design Considerations" Article in the Evaluations for discussion.

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Condensate Drain Pans:

First option in first subparagraph below is minimum slope in ASHRAE 62.1.

Fabricated with **[one] [two]** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

ASHRAE compliance option in "Length" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first option in first subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, and as required by authorities having jurisdiction; otherwise, insert distance.

Length: Extend drain pan downstream from leaving face **[to comply with ASHRAE 62.1] <Insert distance>**.

Depth: A minimum of **[1 inch] <Insert depth>** deep.

Retain one of first two subparagraphs below.

Single-wall, **[galvanized] [stainless]**-steel sheet.

Double-wall, **[galvanized] [stainless]**-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on **[one end] [both ends]** of pan.

Minimum Connection Size: **[NPS 1] [NPS 2] <Insert size>**.

Retain first subparagraph below for galvanized-steel drain pans; delete for stainless-steel drain pans.

Pan-Top Surface Coating: Asphaltic waterproofing compound.

Air Filtration Section:

See Evaluations for discussion on filter characteristics and applications. LEED 2009 Prerequisite IEQ 1 and LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher. See "Sustainable Design Considerations" Article in the Evaluations for discussion.

General Requirements for Air Filtration Section:

Comply with NFPA 90A.

Minimum MERV according to ASHRAE 52.2.

Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

Disposable Panel Filters:

Retain one or more of first six subparagraphs below, as applicable. If Project has more than one filter type, indicate filter type for each unit on Drawings.

Factory-fabricated, viscous-coated, flat-panel type.

Thickness: **[1 inch] [2 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[5] <Insert value>**.

Media: Interlaced glass fibers sprayed with nonflammable adhesive**[ and antimicrobial agent]**.

Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

Extended-Surface, Disposable Panel Filters:

Factory-fabricated, dry, extended-surface type.

Thickness: **[1 inch] [2 inches] [4 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[7] <Insert value>**.

Media: Fibrous material formed into deep-V-shaped pleats**[ with antimicrobial agent]** and held by self-supporting wire grid.

Media-Grid Frame: **[Nonflammable cardboard] [Galvanized steel] [Fire-retardant, 3/4-inch particleboard with gaskets]**.

Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

* + - 1. INDOOR UNITS (6 TONS OR MORE)
         1. Concealed Evaporator-Fan Components:

Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

Insulation: Faced, glass-fiber duct liner.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

Retain one of first two subparagraphs below if heating coil is required.

Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

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.

Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

Fan Motors:

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

Multitapped, multispeed with internal thermal protection and permanent lubrication.

Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.

Wiring Terminations: Connect motor to chassis wiring with plug connection.

ASHRAE compliance in "Airstream Surfaces" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first subparagraph to comply with LEED Prerequisite IEQ 1.

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

The smaller casings of these units do not typically permit extensive filtration choices.

Filters: **[1 inch thick, in fiberboard frames] [Permanent, cleanable]**.

Condensate Drain Pans:

First option in first subparagraph below is minimum slope in ASHRAE 62.1.

Fabricated with **[one] [two]** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

ASHRAE compliance option in "Length" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first option in first subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, and as required by authorities having jurisdiction; otherwise, insert distance.

Length: Extend drain pan downstream from leaving face **[to comply with ASHRAE 62.1] <Insert distance>**.

Depth: A minimum of **[2 inches] <Insert depth>** deep.

Retain one of first two subparagraphs below. Retain second subparagraph if drain-pan temperature is expected to fall below surrounding dew point temperature.

Single-wall, **[galvanized] [stainless]**-steel sheet.

Double-wall, **[galvanized] [stainless]**-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on **[one end] [both ends]** of pan.

Minimum Connection Size: **[NPS 1] [NPS 2] <Insert size>**.

Retain first subparagraph below for galvanized-steel drain pans; delete for stainless-steel drain pans.

Pan-Top Surface Coating: Asphaltic waterproofing compound.

Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

* + - * 1. Floor-Mounted, Evaporator-Fan Components:

Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.

Discharge Grille: **[Steel with surface-mounted frame] [Welded steel bars forming a linear grille and welded into supporting panel]**.

Insulation: Faced, glass-fiber duct liner.

Condensate Drain Pans:

First option in first subparagraph below is minimum slope in ASHRAE 62.1.

Fabricated with **[one] [two]** percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

ASHRAE compliance option in "Length" subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first option in first subparagraph below to comply with LEED 2009 Prerequisite IEQ 1, LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance, and as required by authorities having jurisdiction; otherwise, insert distance.

Length: Extend drain pan downstream from leaving face **[to comply with ASHRAE 62.1] <Insert distance>**.

Depth: A minimum of **[2 inches] <Insert depth>** deep.

Retain one of first two subparagraphs below. Retain second subparagraph if drain-pan temperature is expected to fall below surrounding dew point temperature.

Single-wall, **[galvanized] [stainless]**-steel sheet.

Double-wall, **[galvanized] [stainless]**-steel sheet with space between walls filled with foam insulation and moisture-tight seal.

Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on [one end] [both ends] of pan.

Minimum Connection Size: **[NPS 1] [NPS 2] <Insert size>**.

Retain first subparagraph below for galvanized-steel drain pans; delete for stainless-steel drain pans.

Pan-Top Surface Coating: Asphaltic waterproofing compound.

Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

Retain one of first two subparagraphs below if heating coil is required.

Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.

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.

Fan: Direct drive, centrifugal**[, with power-induced outside air]**.

Fan Motors:

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

Multitapped, multispeed with internal thermal protection and permanent lubrication.

Retain first subparagraph below if enclosure is not open-dripproof type. Retain second subparagraph for premium efficiency.

Enclosure Type: Totally enclosed, fan cooled.

NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

Retain first subparagraph below to require that disconnect switches be supplied with unit.

Mount unit-mounted disconnect switches on [exterior] [interior] of unit.

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

**<Insert unique motor characteristics>**.

Air Filtration Section:

See Evaluations for discussion on filter characteristics and applications. LEED 2009 Prerequisite IEQ 1 and LEED v4 IEQ Prerequisite Minimum Indoor Air Quality Performance require compliance with ASHRAE 62.1, which requires a MERV rating of 6 or higher. See "Sustainable Design Considerations" Article in the Evaluations for discussion.

General Requirements for Air Filtration Section:

Comply with NFPA 90A.

Minimum MERV according to ASHRAE 52.2.

Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

Disposable Panel Filters:

Retain one or more of first six subparagraphs below, as applicable. If Project has more than one filter type, indicate filter type for each unit on Drawings.

Factory-fabricated, viscous-coated, flat-panel type.

Thickness: **[1 inch] [2 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[5] <Insert value>**.

Media: Interlaced glass fibers sprayed with nonflammable adhesive**[ and antimicrobial agent]**.

Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

Extended-Surface, Disposable Panel Filters:

Factory-fabricated, dry, extended-surface type.

Thickness: **[1 inch] [2 inches] [4 inches]**.

Dust-Holding Capacity: **<Insert lb>**.

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

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

MERV according to ASHRAE 52.2: **[7] <Insert value>**.

Media: Fibrous material formed into deep-V-shaped pleats**[ with antimicrobial agent]** and held by self-supporting wire grid.

Media-Grid Frame: **[Nonflammable cardboard] [Galvanized steel] [Fire-retardant, 3/4-inch particleboard with gaskets]**.

Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

Paragraph below is an example of variable-frequency controllers. Retain features and attributes to suit Project, and verify their availability with listed manufacturers.

* + - * 1. Variable-Frequency Controllers:

Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, three-phase induction motor by adjusting output voltage and frequency.

Output Rating: Three-phase; 6 to **[60 Hz, with voltage proportional to frequency throughout voltage range] [66 Hz, with torque constant as speed changes] [120 Hz, with horsepower constant throughout speed range]**.

Unit Operating Requirements:

Input ac voltage tolerance of **[208 V, plus or minus 5] [380 to 500 V, plus or minus 10] [525 to 575 V, plus or minus 10]** percent.

Input-frequency tolerance of 06/11 Hz, plus or minus 6 percent.

Minimum Efficiency: 96 percent at 60 Hz, full load.

Minimum Displacement Primary-Side Power Factor: 96 percent.

Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.

Starting Torque: 100 percent of rated torque or as indicated.

Speed Regulation: Plus or minus 1 percent.

Isolated control interface to allow controller to follow control signal over an 11:1 speed range.

Internal Adjustability Capabilities:

Minimum Speed: 5 to 25 percent of maximum rpm.

Maximum Speed: 80 to 100 percent of maximum rpm.

Acceleration: 2 seconds to a minimum of 22 seconds.

Deceleration: 2 seconds to a minimum of 22 seconds.

Current Limit: 50 percent to a minimum of 110 percent of maximum rating.

Self-Protection and Reliability Features:

Retain one or more of first nine subparagraphs below.

Input transient protection by means of surge protection devices (SPDs).

Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.

Adjustable motor overload relays capable of NEMA ICS 2, **[Class 10] [Class 20] [Class 30]** performance.

Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.

Instantaneous line-to-line and line-to-ground overcurrent trips.

Loss-of-phase protection.

Reverse-phase protection.

Short-circuit protection.

Motor overtemperature fault.

Revise first four subparagraphs below to suit Project; delete if not applicable.

Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads, spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.

Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.

Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back, based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Door-mounted, digital status lights shall indicate the following conditions:

Power on.

Run.

Overvoltage.

Line fault.

Overcurrent.

External fault.

Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual-speed-control potentiometer and elapsed-time meter.

Meters or digital readout devices and selector switch, mounted flush in controller door and connected, to indicate the following controller parameters:

Output frequency (Hertz).

Motor speed (rpm).

Motor status (running, stop, fault).

Motor current (amperes).

Motor torque (percent).

Fault or alarming status (code).

Proportional-integral-derivative feedback signal (percent).

DC-link voltage (volts dc).

Set-point frequency (Hertz).

Motor output voltage (volts).

Control Signal Interface:

Electric Input Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4-20 mA) and six programmable digital inputs.

Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:

0 to 10-V dc.

0-20 or 4-20 mA.

Potentiometer using up/down digital inputs.

Fixed frequencies using digital inputs.

RS485.

Keypad display for local hand operation.

Output signal interface with a minimum of one analog output signal (0/4-20 mA), which can be programmed to any of the following:

Output frequency (Hertz).

Output current (load).

DC-link voltage (volts dc).

Motor torque (percent).

Motor speed (rpm).

Set-point frequency (Hertz).

Remote indication interface with a minimum of two dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

Motor running.

Set-point speed reached.

Fault and warning indication (overtemperature or overcurrent).

High- or low-speed limits reached.

Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

Coordinate both subparagraphs below with manufacturers; not all manufacturers offer all optional features below.

Integral Disconnecting Means: **[NEMA AB 1, instantaneous-trip circuit breaker] [NEMA AB 1, molded-case switch] [NEMA KS 1, nonfusible switch] [NEMA KS 1, fusible switch]** with lockable handle.

Accessories:

Devices shall be factory installed in controller enclosure unless otherwise indicated.

Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

Standard Displays:

Output frequency (Hertz).

Set-point frequency (Hertz).

Motor current (amperes).

DC-link voltage (volts dc).

Motor torque (percent).

Motor speed (rpm).

Motor output voltage (volts).

* + - 1. OUTDOOR UNITS (5 TONS OR LESS)
         1. Air-Cooled, Compressor-Condenser Components:

Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Compressor Type: Scroll.

Feature in first subparagraph below is not available from all manufacturers.

Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

LEED 2009 EA Prerequisite 3 and LEED v4 EA Prerequisite: Fundamental Refrigerant Management require zero use of CFC-based refrigerants. LEED 2009 Credit EA 4 awards two points and LEED v4 EA Credit: Enhanced Refrigerant Management awards one point for using refrigerants that minimize or eliminate ozone depletion. R-407C and R-410A are HCFC-free refrigerants.

Refrigerant: **[R-22] [R-407C] [R-410A] <Insert type>**.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

Retain first subparagraph below for heat-pump units.

Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

Fan: Aluminum-propeller type, directly connected to motor.

Motor: Permanently lubricated, with integral thermal-overload protection.

Low Ambient Kit: Permits operation down to 45 deg F.

Mounting Base: Polyethylene.

* + - 1. OUTDOOR UNITS (6 TONS OR MORE)
         1. Air-Cooled, Compressor-Condenser Components:

Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Compressor Type: Scroll.

Feature in first subparagraph below is not available from all manufacturers.

Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

LEED 2009 EA Prerequisite 3 and LEED v4 EA Prerequisite: Fundamental Refrigerant Management require zero use of CFC-based refrigerants. LEED 2009 Credit EA 4 awards two points and LEED v4 EA Credit: Enhanced Refrigerant Management awards one point for using refrigerants that minimize or eliminate ozone depletion. R-407C and R-410A are HCFC-free refrigerants.

Refrigerant: **[R-407C] [R-410A] <Insert type>**.

Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

Retain first subparagraph below for heat-pump units.

Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

Fan: Aluminum-propeller type, directly connected to motor.

Motor: Permanently lubricated, with integral thermal-overload protection.

Low Ambient Kit: Permits operation down to 45 deg F.

Mounting Base: Polyethylene.

* + - * 1. Water-Cooled, Compressor-Condenser Components:

Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Compressor Type: Scroll.

Feature in first subparagraph below is not available from all manufacturers.

Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

LEED 2009 EA Prerequisite 3 and LEED v4 EA Prerequisite: Fundamental Refrigerant Management require zero use of CFC-based refrigerants. LEED 2009 Credit EA 4 awards two points and LEED v4 EA Credit: Enhanced Refrigerant Management awards one point for using refrigerants that minimize or eliminate ozone depletion. R-407C and R-410A are HCFC-free refrigerants.

Refrigerant: **[R-22] [R-407C] [R-410A] <Insert type>**.

Retain first subparagraph below for heat-pump units.

Heat-Pump Components: Reversing valve.

Heat Exchanger: Copper tubes in copper tube or in steel shell, with water-temperature-actuated, water-regulating valve.

* + - 1. ACCESSORIES

Retain one of first three paragraphs below. Retain first paragraph if controls are part of overall temperature control system.

* + - * 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."
        2. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
        3. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

Compressor time delay.

24-hour time control of system stop and start.

Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.

Fan-speed selection including auto setting.

* + - * 1. Automatic-reset timer to prevent rapid cycling of compressor.
        2. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
        3. Drain Hose: For condensate.

LEED 2009-NC and LEED 2009 for Schools Credit EA 5, LEED 2009-CI Credit EA 3, and LEED 2009-CS Credit EA 5.1 require continuous metering equipment for monitoring building energy consumption performance over time. Retain "Monitoring" paragraph below if required to comply with requirements for this credit. LEED v4 EA Credit: Advanced Energy Metering requires that all whole building energy sources be metered and stored; requirements below may not be required by this credit, but they can be helpful in determining efficiency and trends. Verify availability of control features with unit manufacturers or if required by Project requirements or authorities having jurisdiction.

* + - * 1. Monitoring:

Monitor constant and variable motor loads.

Monitor variable-frequency-drive operation.

Monitor economizer cycle.

Monitor cooling load.

Monitor air distribution static pressure and ventilation air volumes.

* + - 1. CAPACITIES AND CHARACTERISTICS
         1. Cooling Capacity:

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

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

Retain "SEER" subparagraph below for units with capacities 5 tons and less.

SEER: **[10.0] [12.0] [13.0] [14.0] [16.0] <Insert ratio>**.

Retain "EER" subparagraph below for units with capacities 6 tons or more.

EER: **[10.0] [12.0] [13.0] [14.0] [16.0 ] <Insert ratio>**.

Moisture Removal: **<Insert pints/h>**.

Entering-Air Temperature:

Dry Bulb: **<Insert deg F>**.

Wet Bulb: **<Insert deg F>**.

Leaving-Air Temperature:

Dry Bulb: **<Insert deg F>**.

Wet Bulb: **<Insert deg F>**.

* + - * 1. Heating Capacity:

Type: **[Electric] [Natural gas]**.

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

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

Retain one or both of first two subparagraphs below for heat pumps.

Coefficient of Performance: **<Insert value>**.

Heating Season Performance Factor: **[7.7] [8.0] <Insert value>**.

Retain "Hot Water" subparagraph below for hydronic heating coil.

Hot Water:

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

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

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

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

Retain "Electric Heating Coil" subparagraph below for electric heat.

Electric Heating Coil:

Total Capacity: **<Insert value>** kW.

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

Phase: **[Single] [Poly]**.

Frequency: 60 Hz.

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

Retain "Gas Heating Section" subparagraph below for natural or propane gas heat.

Gas Heating Section:

Input: **<Insert cfh>**.

Output: **<Insert cfh>**.

* + - * 1. Auxiliary Heating Capacity:

If retaining "Electric" option in "Type" subparagraph below, retain five following subparagraphs.

Type: **[Electric] [Natural gas] [Propane]**.

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

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

Phase: **[Single] [Poly]**.

Hertz: 60.

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

Retain two subparagraphs below for auxiliary gas heat.

Input: **<Insert cfh>**.

Output: **<Insert cfh>**.

* + - * 1. Indoor Unit:

Fan Motor Electrical Characteristics:

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

Phase: **[Single] [Poly]**.

Hertz: 60.

Airflow: **<Insert value>** cfm.

* + - * 1. Outdoor Unit:

Type: **[Air cooled] [Water cooled]**.

Electrical Characteristics:

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

Phase: **[Single] [Poly]**.

Hertz: 60.

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

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

Fan Motor Full-Load Amperes: **<Insert value>** A.

Compressor Full-Load Amperes: **<Insert value>** A.

Compressor Locked-Rotor Amperes: **<Insert value>** A.

Sound-Pressure Level: **<Insert value>** dBa.

Retain subparagraph below for water-cooled outdoor units.

Water:

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

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

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

1. EXECUTION
   * + 1. INSTALLATION
          1. Install units level and plumb.
          2. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
          3. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
          4. Equipment Mounting:

Retain first subparagraph below to require ground-mounted units to be installed on cast-in-place concrete equipment bases.

Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Install ground-mounted, compressor-condenser components on polyethylene mounting base.

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 type 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 devices specified in Section 230548.13 "Vibration Controls for HVAC."

* + - * 1. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
      1. CONNECTIONS

Coordinate piping installations and specialty arrangements with schematics on 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.

Retain first subparagraph below for units with hot-water coils.

Water Coil Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return coil connections 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.

Retain subparagraph below for units with remote water-cooled condenser.

Remote, Water-Cooled Condenser Connections: Comply with requirements specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Connect hydronic piping to supply and return connections 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.

* + - * 1. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

Retain paragraph below for units connected to ducts. Coordinate duct installation requirements with schematics on 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 split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."
      1. FIELD QUALITY CONTROL

Retain first paragraph below to require a factory-authorized service representative to perform inspections, tests, and adjustments.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

Retain first paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform tests and inspections.

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

Manufacturer's Field Service: Engage a Company Service Advisor to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

Retain first paragraph below to describe tests and inspections to be performed.

* + - * 1. Tests and Inspections:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

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. Remove and replace malfunctioning units and retest as specified above.
        2. Prepare test and inspection reports.
      1. STARTUP SERVICE
         1. [Engage a Company Field Advisor per OGS Spec Section 014216to perform] [Perform] startup service.

Complete installation and startup checks according to manufacturer's written instructions.

**<Insert startup steps if any>**.

* + - 1. DEMONSTRATION
         1. **[Engage a Company Field Advisor per OGS Spec Section 014216 to train] [Train]** Director’s Representative's Facility’s maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126