SECTION 233423 - HVAC POWER VENTILATORS

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

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:

Axial roof ventilators.

Ceiling-mounted ventilators.

Centrifugal ventilators - roof down blast.

Centrifugal ventilators - roof upblast and sidewall.

Sidewall propeller fans.

Upblast propeller roof exhaust fans.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the er-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.

Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.

Rated capacities, operating characteristics, and furnished specialties and accessories.

Certified fan performance curves with system operating conditions indicated.

Certified fan sound-power ratings.

Motor ratings and electrical characteristics, plus motor and electrical accessories.

Material thickness and finishes, including color charts.

Dampers, including housings, linkages, and operators.

Prefabricated roof curbs.

Fan speed controllers.

* + - * 1. Shop Drawings:

Include plans, elevations, sections, and 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.

Include diagrams for power, signal, and control wiring.

Design Calculations: Calculate requirements for selecting vibration isolators [**and seismic restraints**].

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: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.

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: For fans, 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.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For HVAC power ventilators to include in normal and emergency operation, and maintenance manuals.
			2. MAINTENANCE MATERIAL SUBMITTALS
				1. Furnish extra materials[**, from the same product run,**] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Belts: [**One**] <**Insert number**> set(s) for each belt-driven unit.

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. Unusual Service Conditions

Base fan-performance ratings on the following:

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

Altitude: <**Insert feet**> above sea level.

Humidity: <**Insert wet bulb deg F**>.

<**Insert conditions**>.

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: HVAC power ventilators 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 from the device 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 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**].

If Project has more than one type or configuration of HVAC power ventilator, delete "Capacities and Characteristics" paragraph below and schedule ventilators on Drawings.

* + - * 1. Capacities and Characteristics:

Airflow: <**Insert cfm**>.

External Static Pressure: <**Insert inches wg**>.

Fan Diameter: <**Insert inches**>.

Drive Type: [**Direct**] [**Belt**].

Fan rpm: <**Insert number**>.

Tip Speed: <**Insert fpm**>.

Sound: <**Insert number**> sones.

Curb Height: <**Insert inches**>.

Damper: [**Backdraft**] [**Motorized**] [**None**].

Brake Horsepower: <**Insert number**>.

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

Motor rpm: <**Insert number**>.

Motor Enclosure: [**Open dripproof**] [**Totally enclosed, fan cooled**] [**Explosion-proof**].

Electrical Characteristics:

Volts: <**Insert number**> V.

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

Hertz: [**60**] <**Insert number**>.

Accessories: <**Insert accessory description**>.

* + - 1. AXIAL ROOF VENTILATORS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acme Engineering & Manufacturing Corp.

Greenheck Fan Corporation.

Loren Cook Company.

New York Blower Company (The).

Approved equivalent.

Consult manufacturers if AMCA-certified fans are required; not all manufacturers are AMCA members.

Characteristics in remaining paragraphs are examples of HVAC power ventilator specifications. Galvanized-steel and fiberglass housings are also available from some manufacturers.

* + - * 1. Housing: Heavy-gauge, removable, spun-aluminum dome top and outlet baffle; square, one-piece, hinged, aluminum base.
				2. Fan Wheel: [**Aluminum**] [**Steel**] hub and blades. [**Sparkproof construction.**]

Retain "Belt Drives" paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

* + - * 1. Belt Drives:

Resiliently mounted to housing.

Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

Five-hp limit in "Motor Pulleys" subparagraph below is standard with many manufacturers but is designer's choice.

Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**Insert number**> hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than [**5**] <**Insert number**> hp.

* + - * 1. Accessories:

Accessories listed in subparagraphs below are optional features.

Disconnect Switch: Nonfusible type, with thermal-overload protection mounted [**inside**] [**outside**] fan housing, factory wired through an internal aluminum conduit.

Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

Stack hood with built-in backdraft dampers.

Extended lubrication lines.

Specify site-fabricated roof curbs in Section 077200 "Roof Accessories." Retain "Prefabricated Roof Curbs" paragraph below to require roof curbs to be provided by fan manufacturer.

* + - * 1. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**].

Coordinate curb height with roof deck construction; other heights are available. 16-inch height in "Overall Height" subparagraph below is for sound curb.

Overall Height: [**8 inches**] [**9-1/2 inches**] [**12 inches**] [**16 inches**] [**18 inches**].

Subparagraphs below are optional features.

Sound Curb: Curb with sound-absorbing insulation.

Pitch Mounting: Manufacture curb for roof slope.

Metal Liner: Galvanized steel.

Burglar Bars: [**1/2-inch-**] [**5/8-inch-**] [**3/4-inch-**] thick steel bars welded in place to form 6-inch squares.

Mounting Pedestal: Galvanized steel with removable access panel.

* + - 1. CEILING-MOUNTED VENTILATORS

These units are factory assembled with one or more centrifugal wheels of up to 12 inches wide, directly connected to motor, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.

* + - * 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acme Engineering & Manufacturing Corp.

Broan-NuTone LLC.

Greenheck Fan Corporation.

Loren Cook Company.

Approved equivalent.

Consult manufacturers if AMCA-certified fans are required; not all manufacturers are AMCA members.

* + - * 1. Housing: Steel, lined with acoustical insulation.
				2. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
				3. Back-draft damper: Integral.

Grille designs other than those specified in "Grille" paragraph below are available.

* + - * 1. Grille: [**Plastic**] [**Stainless steel**] [**Aluminum**] [**Painted aluminum**], louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
				2. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
				3. Accessories:

Accessories listed in subparagraphs below are optional features.

Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.

Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.

Motion Sensor: Motion detector with adjustable shutoff timer.

Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless steel springs, and fusible link.

Filter: Washable aluminum to fit between fan and grille.

Isolation: Rubber-in-shear vibration isolators.

Manufacturer's standard roof jack or wall cap, and transition fittings.

* + - 1. CENTRIFUGAL VENTILATORS - ROOF DOWNBLAST
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acme Engineering & Manufacturing Corp.

Greenheck Fan Corporation.

New York Blower Company (The).

Approved equivalent.

Consult manufacturers if AMCA-certified fans are required; not all manufacturers are AMCA members.

Painted galvanized-steel and fiberglass housings are also available from some manufacturers.

* + - * 1. Housing: Downblast; removable [**spun-aluminum dome top and outlet baffle**] [**extruded-aluminum rectangular top**] [**galvanized-steel mushroom-domed top**] [**spun aluminum**]; square, one-piece aluminum base with venturi inlet cone.
				2. Fan Wheels: Aluminum hub and wheel with backward-inclined blades[**; sparkproof construction**].

Retain "Belt Drives" paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

* + - * 1. Belt Drives:

Resiliently mounted to housing.

Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

Five-hp limit in "Motor Pulleys" subparagraph below is standard with many manufacturers but is designer's choice.

Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**Insert number**> hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than [**5**] <**Insert number**> hp.

Fan and motor isolated from exhaust airstream.

* + - * 1. Accessories:

Accessories listed in subparagraphs below are optional features.

Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

Disconnect Switch: Nonfusible type, with thermal-overload protection mounted [**inside**] [**outside**] fan housing, factory wired through an internal aluminum conduit.

Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

Spark-resistant, all-aluminum wheel construction.

Mounting Pedestal: Galvanized steel with removable access panel.

Specify site-fabricated roof curbs in Section 077200 "Roof Accessories." Retain "Prefabricated Roof Curbs" paragraph below to require roof curbs to be provided by fan manufacturer.

* + - * 1. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**] [**Manufactured to accommodate roof slope**].

Coordinate curb height with roof deck construction and insulation thickness; other heights are available. 16-inch height in "Overall Height" subparagraph below is for sound curb.

Overall Height: [**8 inches**] [**9-1/2 inches**] [**12 inches**] [**16 inches**] [**18 inches**].

Retain optional roof curb features and accessories below.

Sound Curb: Curb with sound-absorbing insulation.

Hinged sub-base to provide access to damper or as cleanout for grease applications.

Burglar Bars: [**1/2-inch-**] [**5/8-inch-**] [**3/4-inch-**] thick steel bars welded in place to form 6-inch squares.

Pitch Mounting: Manufacture curb for roof slope.

Metal Liner: Galvanized steel.

Mounting Pedestal: Galvanized steel with removable access panel.

* + - 1. CENTRIFUGAL VENTILATORS - ROOF UPBLAST OR SIDEWALL
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acme Engineering & Manufacturing Corp.

Greenheck Fan Corporation.

Loren Cook Company.

New York Blower Company (The).

Approved equivalent.

Consult manufacturers if AMCA-certified fans are required; not all manufacturers are AMCA members.

Painted galvanized-steel and fiberglass housings are also available from some manufacturers.

* + - * 1. Configuration: Centrifugal [**roof upblast**] [**roof upblast, grease hood kitchen**] [**sidewall**] ventilator.
				2. Housing: Removable [**spun-aluminum dome top and outlet baffle**] [**extruded-aluminum rectangular top**] [**galvanized-steel, mushroom-domed top**] [**spun aluminum**]; square, one-piece aluminum base with venturi inlet cone.

Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

[**Provide grease collector.**]

* + - * 1. Fan Wheels: Aluminum hub and wheel with backward-inclined blades [**; sparkproof construction**].

Retain "Belt Drives" paragraph below if belt-driven fans are required; delete if only direct-drive fans are required.

* + - * 1. Belt Drives:

Resiliently mounted to housing.

Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings; minimum ABMA9, [**L(10) of 100,000 hours**] <**Insert life**>.

Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

Five-hp limit in "Motor Pulleys" subparagraph below is standard with many manufacturers but is designer's choice.

Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**Insert number**> hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than [**5**] <**Insert number**> hp.

Fan and motor isolated from exhaust airstream.

* + - * 1. Accessories:

Accessories listed in subparagraphs below are optional features.

Variable-Frequency Motor Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

Disconnect Switch: Nonfusible type, with thermal-overload protection mounted [**inside**] [**outside**] fan housing, factory wired through an internal aluminum conduit.

Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops. The only exception is for grease hood kitchen exhaust.

Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. The only exception is for grease hood kitchen exhaust.

Spark-resistant, all-aluminum wheel construction.

Mounting Pedestal: Galvanized steel with removable access panel.

Wall Mount Adapter: Attach wall-mounted fan to wall.

Restaurant Kitchen Exhaust: UL 762 listed for grease-laden air exhaust.

Specify site-fabricated roof curbs in Section 077200 "Roof Accessories."

Retain "Prefabricated Roof Curbs" or "Prefabricated Kitchen Exhaust Roof Curbs" paragraph below to require roof curbs to be provided by fan manufacturer.

* + - * 1. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**] [**Manufactured to accommodate roof slope**].

* + - * 1. Prefabricated Kitchen Exhaust Roof Curbs: Galvanized steel; mitered and welded corners; ventilation openings on all sides to ventilate curb interstitial space. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**] [**manufactured to accommodate roof slope**].

Coordinate curb height with roof deck construction and insulation thickness; other heights are available. 16-inch (400-mm) height in "Overall Height" subparagraph below is for sound curb.

Overall Height: [**8 inches**] [**9-1/2 inches**] [**12 inches**] [**16 inches**] [**18 inches**].

Select optional roof curb features and accessories below.

Sound Curb: Curb with sound-absorbing insulation[**and galvanized metal liner**].

Hinged sub-base to provide access to damper or as cleanout for grease applications.

Burglar Bars: [**1/2-inch-**] [**5/8-inch-**] [**3/4-inch-**] thick steel bars welded in place to form 6-inch squares.

Pitch Mounting: Manufacture curb for roof slope.

Metal Liner: Galvanized steel.

Mounting Pedestal: Galvanized steel with removable access panel.

Vented Curb: For kitchen exhaust; 12-inch- high galvanized steel; unlined, with louvered vents in vertical sides.

NFPA 96 code requirements for commercial cooking operations.

Kitchen Hood Exhaust: UL 762 listed for grease-laden air.

* + - 1. SIDEWALL PROPELLER FANS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Acme Engineering & Manufacturing Corp.

Carnes Company.

Loren Cook Company.

Approved equivalent.

Review list below if AMCA-certified fans are required; not all manufacturers are AMCA members.

* + - * 1. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.

Retain "Fan Wheels" or "Fan Wheel" paragraph below. Aluminum blades are normally used in large sizes and in high-static-pressure applications.

* + - * 1. Fan Wheels: Formed-steel blades riveted to heavy-gauge steel spider bolted to cast-iron hub.
				2. Fan Wheel: Replaceable, [**cast**] [**extruded**]-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

Retain one of two "Fan Drive" paragraphs below.

* + - * 1. Fan Drive: Direct-drive motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
				2. Fan Drive:

Belt drive.

Resiliently mounted to housing.

Statically and dynamically balanced.

Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

Extend grease fitting to accessible location outside of unit.

Service Factor Based on Fan Motor Size: 1.4.

Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

Ball-Bearing Rating Life: ABMA 9, [**L(10) of 100,000 hours**] <**Insert life**>.

Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.

Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**insert value**> hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.

Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

* + - * 1. Accessories:

Accessories listed in subparagraphs below are optional features.

Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

Dampers: Counterbalanced, parallel-blade, backdraft dampers factory set to close when fan stops. The only exception is for grease hood kitchen exhaust.

Motorized Dampers: Parallel-blade dampers with electric actuator wired to close when fan stops. The only exception is for grease hood kitchen exhaust.

Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

Wall Sleeve: Galvanized steel to match fan and accessory size.

Weathershield Hood: Galvanized steel to match fan and accessory size.

Weathershield Front Guard: Galvanized steel with expanded metal screen.

* + - 1. UPBLAST PROPELLER ROOF EXHAUST FANS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Greenheck Fan Corporation.

Loren Cook Company.

New York Blower Company (The).

Approved equivalent.

Consult manufacturers if AMCA-certified fans are required; not all manufacturers are AMCA members.

Wind bands, fan housings, and bases in "Configuration" paragraph below are available in both aluminum and galvanized steel, depending on unit size. Stainless steel is also available for special applications. Verify materials with manufacturers.

* + - * 1. Configuration: Upblast propeller [**grease hood kitchen**] ventilator.
				2. Wind Band, Fan Housing, and Base: Reinforced and braced [**galvanized steel**] [**aluminum**], containing [**galvanized-steel**] [**aluminum**] butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

Damper Rods: Steel with [**bronze**] [**nylon**] bearings.

Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

[**Provide grease collector.**]

Verify wheel-type availability with manufacturers. Aluminum blades in "Fan Wheel" paragraph below are normally used in large sizes and in high-static-pressure applications.

* + - * 1. Fan Wheel: Replaceable, [**cast**] [**extruded**]-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades[**; sparkproof construction**].

Retain "Belt Drives" paragraph below if belt-driven fans are required; delete if only direct-drive fans are required. Add temperature ratings and other features to drive assembly if these fans are used for smoke exhaust.

* + - * 1. Belt Drives:

Resiliently mounted to housing.

Weatherproof housing of same material as fan housing.

Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.

Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

Five-hp limit in "Motor Pulleys" subparagraph below is standard with many manufacturers but is designer's choice.

Motor Pulleys: Adjustable pitch for use with motors through [**5**] <**Insert number**> hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions. Provide fixed pitch for use with motors larger than [**5**] <**Insert number**> hp.

Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.

* + - * 1. Accessories:

Accessories listed in subparagraphs below are optional features.

Disconnect Switch: Nonfusible type, with thermal-overload protection mounted [**inside**] [**outside**] fan housing, factory wired through an internal aluminum conduit.

Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

Inspection Door: Hinged.

Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops. The only exception is for grease hood kitchen exhaust.

Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. The only exception is for grease hood kitchen exhaust.

Extended Lubrication Lines.

Kitchen Hood Exhaust: UL 762 listed for grease-laden air exhaust**.**

Specify site-fabricated roof curbs in Section 077200 "Roof Accessories."

Retain "Prefabricated Roof Curbs" or "Prefabricated Kitchen Exhaust Roof Curbs" paragraph below to require roof curbs to be provided by fan manufacturer.

* + - * 1. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**].

* + - * 1. Prefabricated Kitchen Exhaust Roof Curbs: Galvanized steel; mitered and welded corners; ventilation openings on all sides to ventilate curb interstitial space. Size as required to suit roof opening and fan base.

Configuration: [**Self-flashing without a cant strip, with mounting flange**] [**Built-in cant and mounting flange**] [**Built-in raised cant and mounting flange**] [**manufactured to accommodate roof slope**].

Coordinate curb height with roof deck construction; other heights are available. 16-inch height in "Overall Height" subparagraph below is for sound curb.

Overall Height: [**8 inches**] [**9-1/2 inches**] [**12 inches**] [**16 inches**] [**18 inches**].

Subparagraphs below are optional features.

Sound Curb: Curb with sound-absorbing insulation.

Hinged sub-base to provide access to damper or as cleanout for grease applications.

Burglar Bars: [**1/2-inch-**] [**5/8-inch-**] [**3/4-inch-**] thick steel bars welded in place to form 6-inch squares.

Pitch Mounting: Manufacture curb for roof slope.

Metal Liner: Galvanized steel.

Mounting Pedestal: Galvanized steel with removable access panel.

Vented Curb: For kitchen exhaust; 12-inch- high galvanized steel; unlined, with louvered vents in vertical sides.

NFPA 96 code requirements for commercial cooking operations.

UL 762 listed for grease-laden air.

* + - 1. MOTORS

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

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

Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

* + - 1. SOURCE QUALITY CONTROL
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

AMCA compliance is an optional requirement and not necessarily available from all manufacturers. Retain "AMCA Certification" paragraph to require AMCA certification. Note that the AMCA website (www.amca.org) lists all certified fans by make and model.

* + - * 1. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.

Sound-power rating information may only be available from manufacturers on request. See discussion on sound and vibration control in the Evaluations.

* + - * 1. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
				2. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
				3. Operating Limits: Classify according to AMCA 99.
				4. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.
1. EXECUTION
	* + 1. INSTALLATION OF HVAC POWER VENTILATORS
				1. Install power ventilators level and plumb.
				2. Equipment Mounting:

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

Install power ventilators on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations 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 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. Secure roof-mounted fans to roof curbs with zinc-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.
				2. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

Retain and revise first paragraph below for suspended units; delete if vibration and seismic controls are specified in "Capacities and Characteristics" paragraph in "Performance Requirements" Article or are indicated on Drawings. If not scheduled, identify required vibration- and seismic-control device by using the titles of devices described in Section 230548 "Vibration and Seismic Controls for HVAC" and identify required static deflection.

* + - * 1. Support suspended units from structure using threaded steel rods and [**elastomeric hangers**] [**spring hangers**] [**spring hangers with vertical-limit stops**] <**Insert device**> having a static deflection of [**1 inch**] <**Insert value**>. Vibration-control devices are specified in [**Section 230548 "Vibration and Seismic Controls for HVAC."**] [**Section 230548.13 "Vibration Controls for HVAC."**]
				2. Install units with clearances for service and maintenance.
				3. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
			1. DUCTWORK CONNECTIONS

Coordinate duct installation and specialty arrangements with schematics on Drawings and with requirements specified in duct systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
			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.

Retain one of two subparagraphs below. First subparagraph cross-references Section 260553 "Identification for Electrical Systems" and should be retained for consistent electrical identification. Second subparagraph 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 first four paragraphs below. Retain first "Testing Agency" paragraph below if Director’s Representative will hire an independent testing agency.

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

* + - * 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a Company Service Advisor to perform tests and inspections.

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

Retain "Perform tests and inspections" paragraph below to require Contractor to perform tests and inspections, and retain optional text to require Contractor to arrange for the assistance of a Company Service Advisor.

* + - * 1. Perform tests and inspections[**with the assistance of a company field advisor**].

Retain test requirements below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Verify that shipping, blocking, and bracing are removed.

Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

Verify that there is adequate maintenance and access space.

Verify that cleaning and adjusting are complete.

Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

Adjust belt tension.

Adjust damper linkages for proper damper operation.

Verify lubrication for bearings and other moving parts.

Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

Shut unit down and reconnect automatic temperature-control operators.

Remove and replace malfunctioning units and retest as specified above.

* + - * 1. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. ADJUSTING
				1. Adjust damper linkages for proper damper operation.
				2. Adjust belt tension.
				3. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
				4. Replace fan and motor pulleys as required to achieve design airflow.
				5. Lubricate bearings.
			2. DEMONSTRATION
				1. [**Engage a company field advisor to train**] [**Train**] Facility’s Director’s Representative's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233423