SECTION 233400 - HVAC FANS

This Section includes centrifugal fans, axial fans, propeller fans, downblast centrifugal roof fans, upblast centrifugal roof fans, centrifugal wall fans, ceiling fans, inline ceiling fans, duct blowers or cabinet fans, centrifugal square inline fans, upblast propeller roof fans, centrifugal filtered supply fans, combination kitchen hood supply and exhaust fans, roof ventilators, energy recovery ventilators, and their accessories.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Centrifugal fans.

Axial fans.

Propeller fans.

Downblast centrifugal roof fans.

Upblast centrifugal roof fans.

Centrifugal wall fans.

Ceiling fans.

Inline ceiling fans.

Duct blowers or cabinet fans.

Centrifugal square inline fans.

Upblast propeller roof fans.

Centrifugal filtered supply fans.

Combination kitchen hood supply and exhaust fans.

Roof ventilators.

Energy recovery ventilator.

* + - * 1. Related Sections:

Section <**\_\_\_\_\_\_\_\_**> - <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>: Roof curbs.

Section <**\_\_\_\_\_\_\_\_**> - <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>: Roof curb flashing.

Section 230513 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.

Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for resilient mountings and snubbers for fans for placement by this section.

Section 230700 - HVAC Insulation: Product requirements for power ventilators for placement by this section.

Section 230900 - Instrumentation and Control for HVAC: Product requirements for control components to interface with fans.

Section 230923 - Direct-Digital Control System for HVAC: Controls remote from unit.

Section 230953 - Pneumatic and Electric Control System for HVAC: Product requirements for pneumatic control components to interface with fans.

Section 233100 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.

Section 233300 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American Bearing Manufacturers Association:

ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

* + - * 1. Air Movement and Control Association International, Inc.:

AMCA 99 - Standards Handbook.

AMCA 204 - Balance Quality and Vibration Levels for Fans.

AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

* + - * 1. American Refrigeration Institute:

ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

* + - * 1. ASTM International:

ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

* + - * 1. National Electrical Manufacturers Association:

NEMA MG 1 - Motors and Generators.

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - * 1. Underwriters Laboratories Inc.:

UL 705 - Power Ventilators.

* + - 1. PERFORMANCE REQUIREMENTS

Include large missile impact test when ventilation ducts connected to louvers are not considered open.

* + - * 1. Wind-Borne Debris Loads: Design louvers located within 30 feet of grade to withstand ASTM E1996; large missile impact test.
			1. SUBMITTALS

Only request submittals needed to verify compliance Project requirements.

* + - * 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. Section 013300 - Submittal Procedures: Submittal procedures.
				5. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
				6. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
				7. Manufacturer's Installation Instructions: Submit fan manufacturer instructions.
				8. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
			2. QUALITY ASSURANCE
				1. Performance Ratings: Conform to AMCA 210 (Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating) [**and bear AMCA Certified Rating Seal.**]
				2. Sound Ratings: AMCA 301 (Methods for Calculating Fan Sound Ratings From Laboratory Test Data), tested to AMCA 300 (Reverberant Room Methods for Sound Testing of Fans) [**,and bear AMCA Certified Sound Rating Seal.**]
				3. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705 (Standard for Safety Power Ventilators).
				4. Balance Quality: Conform to AMCA 204 (Balance Quality and Vibration Levels for Fans).
				5. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060 (Rating Air-To-Air Energy Recovery Ventilation Heat Exchangers).
				6. Perform Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one copy**] [**<\_\_\_\_\_\_\_\_> copies**] of [**each**] document on site.
			1. QUALIFICATIONS
				1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
				2. Installer: Company specializing in performing Work of this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**approved by manufacturer**].
			2. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Protect motors, shafts, and bearings from weather and construction dust.
			4. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			5. WARRANTY

This article extends warranty period beyond one year. Extended warranties increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for fans.
			1. MAINTENANCE SERVICE

Evaluate need for maintenance and emergency service based Project requirements. If desired, retain the following paragraphs.

* + - * 1. Furnish service and maintenance of fans for [**one**] [**five**] years from Date of Substantial Completion.
				2. Examine [**each fan**] components [**weekly**] [**semi-monthly**] [**monthly**] [**bi-monthly**]. Clean, adjust, and lubricate equipment.
				3. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
				4. Perform work without removing fans from service during building normal occupied hours.
				5. Provide emergency call back service [**at all hours**] [**during working hours**] for this maintenance period.
				6. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
				7. Perform maintenance work using competent and qualified personnel under supervision [**and in direct employ**] of manufacturer or original installer.
				8. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of [**Director’s Representative.**] <**\_\_\_\_\_\_\_\_.**>
			1. EXTRA MATERIALS
				1. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> sets of belts for each fan.
1. PRODUCTS
	* + 1. CENTRIFUGAL FANS

In this article, list manufacturers acceptable for this Project.

* + - * 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:

Acme Engineering & Manufacturing Corp.

Canarm Ltd.

Central Blower Company.

Lau Fan.

New York Blower Company (The).

Plastec Ventilation Inc.

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Performance:

Performance Base: [**Sea level**] <**\_\_\_\_\_\_\_\_**> conditions.

Temperature Limit: Maximum [**300 degrees F**] [**600 degrees F**] [**<\_\_\_\_\_\_\_\_> degrees F**].

Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

* + - * 1. Wheel and Inlet:

Aluminum construction is found only in high-pressure fan wheels. Cast steel hub is common on AMCA 99 Class III fans.

Backward Inclined: Steel [**or aluminum**] construction with smooth curved inlet flange, back plate, backward curved blades welded or riveted to flange and back plate; cast iron [**or cast steel**] hub riveted to back plate and keyed to shaft with set screws.

Forward Curved: [**Black enamel**] [**Galvanized**] steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.

Airfoil Wheel: Steel construction with smooth curved inlet flange, back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron [**or cast steel**] hub riveted to back plate and keyed to shaft with set screws.

Radial: Steel construction with [**inlet flange,**] [**reinforced**] back plate, plate blades [**with reinforcing gussets**] [**and**] [**wearing strips**] welded or riveted to back plate [**and flange**]; cast iron [**or cast steel**] hub riveted to back plate and keyed to shaft with set screws.

* + - * 1. Housing:

Steel, spot welded [**for AMCA 99 Class I and II fans, and continuously welded for Class III**], braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.

Factory finish before assembly to manufacturer's standard. For fans handling air downstream of humidifiers, [**furnish two additional coats of paint.**] [**fabricate of galvanized steel.**] [**Prime coating on aluminum parts is not required.**]

Bolted construction with horizontal flanged split housing [**, where indicated**].

Fabricate plug fans without volute housing, in lined steel cabinet.

* + - * 1. Bearings and Sleeves:

Bearing life is percent failure at rated hours; i.e., L-10 life at 50,000 hours means 10 percent of bearings may be expected to fail at 50,000 hours.

Bearings: Pillow block type, self-aligning, grease-lubricated [**ball bearings, with ABMA 9 [L-10 life at 50,000 hours] [L-50 life at 100,000 hours]**] [**roller bearings, or ABMA 11, [L-10 life at 120,000 hours] [L-50 life at 400,000 hours]**].

Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.

V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.

Belt Guard: Fabricate to SMACNA Standard; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.

Adjustable Inlet Vanes: Steel construction with blades [**supported at both ends**] [**cantilevered**] with two permanently lubricated bearings, variable mechanism [**out of air stream**] terminating in single control lever with control shaft for double width fans [**and locking quadrant**].

Discharge Dampers: [**Parallel**] [**Opposed**] blade steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.

Inlet/Outlet Screens: Galvanized steel welded grid.

Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.

Scroll Drain: 1/2 inch steel pipe coupling welded to low point of fan scroll.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Capacity:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inches wg.

RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Motors: In accordance with Section 230513. Type: [**Open drip proof**] [**TEFC**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>.**]

Controls: <**\_\_\_\_\_\_\_\_**>.

Disconnect Switch: Factory mount disconnect switch in [**control panel**] [**on equipment**].

* + - 1. AXIAL FANS

In this article, list manufacturers acceptable for this Project.

* + - * 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:

Acme Engineering & Manufacturing Corp.

Aerovent; a division of Twin City Fan Companies, Ltd.

Airmaster Fan; a brand of MAICO.

American Coolair Corporation.

Carnes Company.

Chicago Blower Corporation.

Cincinnati Fan.

Greenheck Fan Corporation.

Hartzell Fan Incorporated.

Howden American Fan Company.

Lau Fan.

Loren Cook Company.

New York Blower Company (The).

Northern Blower, Inc.

Peerless Blowers.

PennBarry; division of Air System Components.

Rupp Air Management Systems.

S & P Products.

Trane Inc.

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Product Requirements:

Performance Base: [**Sea level**] <**\_\_\_\_\_\_\_\_**> conditions.

Temperature Limit: Maximum [**300 degrees F**] [**600 degrees F**] [**<\_\_\_\_\_\_\_\_> degrees F**].

* + - * 1. Hub and Impeller:

Airfoil Impeller Blades: Adjustable die cast aluminum alloy [**or glass reinforced polyester resin**] [**or welded steel die formed blades with belt drive**].

Hub: Die cast aluminum alloy or cast iron hub [**or with belt drive of spun, welded steel**], bored and keyed to shaft; to facilitate indexing of blade angle with [**manual**] [**automatic**] adjustment stops.

Controllable Pitch Assemblies: Incorporate ball bearing counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator, or pneumatic or electric actuator incorporated within hub.

Cast Components: X-ray components after fabrication and statically and dynamically balance assembly before attachment to motor or shaft.

* + - * 1. Casing:

Fabricate casing of [**1/4 inch**] [**<\_\_\_\_\_\_\_\_> inch**] steel for fans [**40 inch**] [**50 inch**] [**<\_\_\_\_\_\_\_\_> inch**] in diameter and smaller and [**3/8 inch**] [**<\_\_\_\_\_\_\_\_> inch**] steel for larger fans.

Continuously weld, with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than [**one inch wg**] [**1.5 inch wg**] [**2 inches wg**] [**<\_\_\_\_\_\_\_\_> inches wg**].

Finish [**with one coat enamel applied to interior and exterior**] [**by hot dip galvanizing finished assembly**].

* + - * 1. Bearings and Drives:

Bearing life means at rated hours, percent failure is anticipated; i.e. L-10 life at 50,000 hours means 10 percent of bearings may be expected to have failed at 50,000 hours.

Bearings: Pillow block type, self-aligning, grease-lubricated [**ball bearings, with ABMA 9 [L-10 life at 50,000 hours] [L-50 life at 100,000 hours]**] [**roller bearings, or ABMA 11, [L-10 life at 120,000 hours] [L-50 life at 400,000 hours]**].

Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.

V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.

Belt Guard: Fabricate to SMACNA Standards; 0.106 inch thick, 3/4 inch diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

Lubrication: Extend lubrication fittings to outside of casing.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Guide Vanes: Welded steel construction with airfoil vanes and casing flanges, finished to match casing.

Adjustable Inlet Vanes: Steel construction with blades [**supported at both ends**] [**cantilevered**] with two permanently lubricated bearings, variable mechanism [**out of air stream**] terminating in single control lever with control shaft for double width fans [**and locking quadrant**].

Inlet Bell: Bell mouth inlet fabricated of [**steel**] [**aluminum**] [**fiberglass reinforced plastic**] with flange.

Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of [**1.5/1.0**] <**\_\_\_\_\_\_\_\_**>, with center pod as recommended by manufacturer.

Inlet Screens: Galvanized steel welded grid to fit inlet bell.

Dampers: Welded steel construction, consisting of two semi-circular vanes pivoted on oil-retaining bearings in short casing section, finished [**with one coat enamel**] [**by hot dip galvanizing**]. Furnish [**air stream operation closing blades by reverse airflow and gravity**] [**hand operation with hand wheel control of screw and link mechanism**] [**motor actuation; refer to Section [230900] [230923] [230953]**].

Access Doors: Shaped to conform to casing with quick opening latches and gaskets.

Blade Pitch Actuator: Factory mounted and calibrated, [**electric actuator requiring single phase power and accepting electric input**] [**electric actuator requiring single phase power and accepting pneumatic control input signal**] [**pneumatic actuator requiring [25 psi] main supply pressure and accepting pneumatic control input signal**]. [**Refer to Section [230900] [230923] [230953].**]

Stall Alarm Probe: Factory installed sensing probe to detect fan operation in stall.

Vibration Detector: Factory installed vibration switch to stop fan [**with extra set of contacts**].

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Capacity:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Motors: In accordance with Section 230513. Type: [**Open drip proof**] [**TEFC**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>.**]

Controls: <**\_\_\_\_\_\_\_\_**>.

Disconnect Switch: Factory mount disconnect switch in [**control panel**] [**on equipment**].

* + - 1. PROPELLER FANS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Bayley Fan Group

Cool (Loren) Co.

Greenheck Fan Corp.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Construction:

Impeller: Shaped steel or steel reinforced aluminum blade with hubs, statically and dynamically balanced, [**keyed and**] locked to shaft, directly connected to motor [**or furnished with V-belt drive**].

Frame: One piece, square steel with die formed venturi orifice, mounting flanges and supports, with baked enamel finish.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Back-draft Damper: Multiple blade with offset hinge pin, blades linked.

Outlet Damper: Multiple blade with offset hinge pin, blades linked, line voltage motor drive, power open, spring return.

Safety Screens: Expanded galvanized metal over inlet, motor, and drive [**and outlet**]; to comply with OSHA regulations.

Hood: Weather shield, to exclude rain and snow.

Only use fan speed controller with direct drive fans.

Fan speed controller.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Capacity:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inches wg.

RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Motors: In accordance with Section 230513. Type: [**Open drip proof**] [**TEFC**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>.**]

Controls: <**\_\_\_\_\_\_\_\_**>.

Disconnect Switch: Factory mount disconnect switch in [**control panel**] [**on equipment**].

* + - 1. DOWNBLAST CENTRIFUGAL ROOF FANS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Bayley Fan Group

Cook (Loren) Co.

Greenheck Fan Corp.

Twin City Fan and Blower Co.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Fan Unit: Downblast type. [**V-belt**] [**direct**] drive, with [**spun aluminum**] [**galvanized steel with baked-on enamel**] [**fiberglass reinforced plastic**] housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
				2. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				3. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**8 inch**] [**12 inch**] [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.
				2. Disconnect Switch: Factory wired, non-fusible, in fan housing for thermal overload protected motor, NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [**and line voltage motor drive, power open, spring return**].

Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and [**line**] <**\_\_\_\_\_\_\_\_**> voltage motor drive, power [**open**] [**closed**], [**spring return**] <**\_\_\_\_\_\_\_\_**>.

Only use fan speed controller with direct drive fans.

Fan speed controller.

<**\_\_\_\_\_\_\_\_**>.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan Tip Speed: <**\_\_\_\_\_\_\_\_**> fpm.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. UPBLAST CENTRIFUGAL ROOF FANS

In this article, list manufacturers acceptable for this Project.

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

Bayley Fan Group

Cook (Loren) Co.

Greenheck Fan Corp.

Twin City Fan and Blower Co.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Fan Unit: Upblast type. [**V-belt**] [**direct**] drive, spun aluminum housing with grease tray; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
				2. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				3. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.
				2. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [**and line voltage motor drive, power open, spring return**].

Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and [**line**] <**\_\_\_\_\_\_\_\_**> voltage motor drive, power [**open**] [**closed**], [**spring return**] <**\_\_\_\_\_\_\_\_**>.

Only use fan speed controller with direct drive fans.

Fan speed controller.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan Tip Speed: <**\_\_\_\_\_\_\_\_**> fpm.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. CENTRIFUGAL WALL FANS

In this article, list manufacturers acceptable for this Project.

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

Bayley Fan Group

Cook (Loren) Co.

Greenheck Fan Corp.

Twin City Fan and Blower Co.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Fan Unit: [**V-belt**] [**direct**] drive with spun aluminum housing; resiliently mounted motor; aluminum wire bird screen.
				2. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				3. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].
				4. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [**and line voltage motor drive, power open, spring return**].

Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and [**line**] <**\_\_\_\_\_\_\_\_**> voltage motor drive, power [**open**] [**closed**], [**spring return**] <**\_\_\_\_\_\_\_\_**>.

Only use fan speed controller with direct drive fans.

Fan speed controller.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan Tip Speed: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. CEILING FANS

In this article, list manufacturers acceptable for this Project.

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

Brod & McClung - Pace Co.

Penn Ventilator Co., Inc.

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Centrifugal Fan Unit: Direct driven with [**injection molded resin**] [**galvanized steel**] housing [**lined with 1/2 inch acoustic insulation**], resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar. [**Discharge position convertible by moving interchangeable panels.**]
				2. Disconnect Switch: [**Cord and plug in housing**] [**Fan mounted toggle switch**] for thermal overload protected motor.
				3. Grille: [**Molded white plastic**] [**Aluminum [with baked white enamel finish]**] [**Painted steel**].
				4. Wheel: [**DWDI**] Centrifugal forward curved type constructed of injection molded or polypropylene resin.
				5. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Wall cap with damper, round duct inlet.

Wall cap with rectangular duct inlet.

Eave elbow.

Roof jack constructed of corrosion resistant, galvanized steel with baked enamel finish.

Roof cap [**with roof curb**].

Filter box.

Brick vent constructed of extruded aluminum with inlet screen.

Rubber-in-shear vibration isolator.

Ceiling radiation damper.

Only use fan speed controller with direct drive fans.

Fan speed controller.

Time delay relay.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Sones: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. INLINE CEILING FANS

In this article, list manufacturers acceptable for this Project.

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

Brod & McClung - Pace Co.

Penn Ventilator Co., Inc.

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Configuration: Inline.
				2. Centrifugal Fan Unit: Direct driven with [**injection molded resin**] [**galvanized steel**] housing [**lined with 1/2 inch acoustic insulation**], resilient mounted motor, gravity backdraft damper in discharge opening, integral inlet and outlet duct collar.
				3. Disconnect Switch: [**Cord and plug in housing**] [**Fan mounted toggle switch**] for thermal overload protected motor.
				4. Wheel: [**Double width, double inlet**] Centrifugal forward curved type constructed of injection molded or polypropylene resin.
				5. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection, mounted on rubber-shear isolators.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Sones: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. DUCT BLOWER OR CABINET FANS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

AMETEK

Dayton

Noren Thermal Solutions

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Product Description: V-belt drive with galvanized steel housing [**lined with [1/2] [1] <\_\_\_\_\_\_\_\_> inch acoustic glass fiber insulation**], removable side panel for access, inlet and outlet duct collar, [**gravity backdraft damper in discharge,**] horizontal hanging brackets.
				2. Fan Wheel: Double width-double inlet [**backward inclined**] [**forward curved**] centrifugal type.
				3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				4. Motor and Drive Mounting: [**Out of**] [**Within**] air stream.
				5. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Two speed**] [**Explosion proof**] type mounted on vibration isolators. [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].
				6. Bearings: ABMA 9 life at 200,000 hours.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Belt guard.

Disconnect Switch: NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Slide out filter box with [**permanent**] [**throwaway**] type filter.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. CENTRIFUGAL SQUARE INLINE FANS

In this article, list manufacturers acceptable for this Project.

* + - * 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:

Acme Engineering & Manufacturing Corp.

Aerovent; a division of Twin City Fan Companies, Ltd.

American Coolair Corporation.

Canarm Ltd.

Carnes Company.

FloAire National.

Greenheck Fan Corporation.

Hartzell Fan Incorporated.

JencoFan.

Loren Cook Company.

PennBarry; division of Air System Components.

Quietaire Inc.

Rupp Air Management Systems.

S & P USA Ventilation Systems, LLC.

Approved equivalent.

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Product Description: [**V-belt**] [**Direct**] drive with galvanized steel housing [**lined with [1/2] [1] <\_\_\_\_\_\_\_\_> inch acoustic glass fiber insulation**], integral inlet cone, removable access doors on 3 sides, inlet and outlet duct collar, [**gravity backdraft damper in discharge,**] horizontal hanging brackets.
				2. Fan Wheel: Backward inclined centrifugal type, aluminum construction.
				3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				4. Motor and Drive Mounting: Out of air stream.
				5. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].
				6. Bearings: ABMA 9 life at 200,000 hours.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Belt guard.

Motor cover.

Inlet safety screen.

Outlet safety screen.

Flexible duct connector.

Filter box with [**permanent**] [**throwaway**] type filter.

Flanged [**inlet**] [**outlet**].

[**Inlet**] [**Outlet**] ductwork companion flange.

Disconnect Switch: NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Only use fan speed controller with direct drive type fans.

Fan speed controller.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. UPBLAST PROPELLER ROOF FANS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Bayley Fan Group

Cook (Loren) Co.

Greenheck Fan Corp.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Fan Unit: [**V-belt**] [**direct**] drive, with [**aluminum**] [**galvanized steel with baked-on enamel**] housing; resilient mounted motor; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets. Butterfly type gravity dampers mounted in discharge air stream.
				2. Blades: Shaped [**steel**] [**aluminum**] air foil blades with heavy hubs, statically and dynamically balanced, [**keyed and**] locked to shaft, directly connected to shaft.
				3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				4. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**8 inch**] [**12 inch**] [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.
				2. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. CENTRIFUGAL FILTERED SUPPLY FAN

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Bayley Fan Group

Cook (Loren) Co.

Greenheck Fan Corp.

Twin City Fan and Blower Co.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Hood: Square configuration, constructed of bolted, galvanized steel housing; insulated top cover, bottom skirt for attachment to roof curb, aluminum wire bird screen.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Hood: Louvered penthouse constructed of extruded aluminum with continuously welded and mitered corners, removable top cap, curb cap constructed of aluminum with continuous curb gaskets, fan support constructed of steel, aluminum wire bird screen.
				2. Fan Unit: Belt driven, double width, double inlet, [**forward curved**] [**backward inclined**], centrifugal blower with [**vibration isolator**] [**resilient**] mounted motor.
				3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
				4. Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].
				5. Filter: [**1**] [**2**] <**\_\_\_\_\_\_\_\_**> inch thick aluminum media, washable and cleanable.

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**8 inch**] [**12 inch**] [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Gravity operated backdraft damper with spring return.

Motorized intake backdraft damper.

Disconnect Switch: NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

* + - 1. COMBINATION KITCHEN HOOD SUPPLY AND EXHAUST FANS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8254&mf=04&src=wd): Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

CaptiveAire

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Exhaust Fan:

Refer to Upblast Centrifugal Roof Fans elsewhere in this section.

* + - * 1. Supply Fan:

Fan Unit: Belt driven, double width, double inlet centrifugal blower, galvanized steel housing with galvannealed finish; resilient mounted motor; square base to suit roof curb.

Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

Motor: [**Open drip proof**] [**Totally enclosed fan cooled**] [**Class 1, Group D, explosion proof**] [**NEMA MG1, <\_\_\_\_\_\_\_\_>**].

* + - * 1. Master Control Panel: Factory wired to disconnect switch for supply fan and disconnect switch for exhaust fan. Furnish with fused magnetic starters, overload protection, wiring terminals and weatherproof housing. Furnish with 120 volt control circuit transformer.
				2. Fresh Air Intake Section: Constructed of galvanized steel. Size as indicated on Drawings. Galvanized steel duct support at end of intake duct.
				3. Filters: [**2**] <**\_\_\_\_\_\_\_\_**> inch thick [**aluminum**] [**glass fiber**] [**polyester**] media, washable and cleanable. Furnish bird screen at filter opening.

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: Sized to accommodate both fans. [**12 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high self-flashing of galvanized steel construction with continuously welded seams, [**built-in cant strips,**] 1-1/2 inch, 3 pound per cubic foot density glass fiber insulation and curb bottom, and factory installed nailer strip.
				2. Curb Cap: Galvanized steel, welded construction. Fits over roof curb to accommodate supply fan and exhaust fan. Insulate with 1-1/2 inch, 3 pound per cubic foot density fiberglass insulation. Furnish vented extension for exhaust fan. Comply with NFPA 96 for fan spacing and vertical separation.
				3. Damper: Motor operated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and [**line**] <**\_\_\_\_\_\_\_\_**> voltage motor drive, power [**open**] [**closed**], [**spring return**] <**\_\_\_\_\_\_\_\_**>.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Exhaust Fan:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Supply Fan:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

The following article is for round or square gravity ventilators constructed of aluminum, galvanized steel or fiberglass. For tiered ventilators use second article.

* + - 1. GRAVITY ROOF VENTILATORS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Carnes Company, Inc.

Cook (Loren) Co.

Greenheck Fan Corp.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Product Description: [**Square**] [**Round**] type, with [**aluminum**] [**galvanized steel with baked-on enamel**] [**fiberglass reinforced plastic**] housing; aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**8 inch**] [**12 inch**] [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.
				2. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked [**and line voltage motor drive, power open, spring return**].
				3. Motor Operated Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked and [**line**] <**\_\_\_\_\_\_\_\_**> voltage motor drive, power [**open**] [**closed**], [**spring return**] <**\_\_\_\_\_\_\_\_**>.

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Application: <**\_\_\_\_\_\_\_\_**>.

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Pressure Drop: <**\_\_\_\_\_\_\_\_**> inch wg.

Size: <**\_\_\_\_\_\_\_\_**> inch by <**\_\_\_\_\_\_\_\_**> inch.

Throat Area: <**\_\_\_\_\_\_\_\_**> square feet.

* + - 1. ENERGY RECOVERY VENTILATOR

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Daikin

Greenheck Fan Corp.

Nortek

Trane Co.

Approved equivalent.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

Edit the following descriptive specifications to identify Project requirements and to eliminate conflicts with manufacturers specified above.

* + - * 1. Unit Casing: Constructed of galvanized steel with bolted construction using corrosion resistant fasteners. Furnish with inlet and outlet duct collars. Top side and interior panels insulated with 1-1/2 inch, 3 pound per cubic foot density glass fiber insulation. Side panels hinged and removable for access to internal components. Energy wheel mounted in sliding tack for access and cleaning. Fans and motor assembly mounted in sliding track for access.
				2. Energy Wheel: Constructed of synthetic fiber-based media impregnated with non-migrating water selective 4 angstrom molecular sieve desiccant.
				3. Fans: Individual supply and exhaust fans. [**Belt**] [**Direct**] drive, [**single width, single inlet**] [**double width, double inlet**], forward curved, centrifugal blower with resilient mounted motor.
				4. Motors: [**Open drip proof**] [**Totally enclosed fan cooled**] with permanently lubricated sealed type bearings with ABMA 9 life at 200,000 hours.
				5. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position.
				6. Filter: 2 inch thick 30 percent efficient pleated type located in both supply and exhaust air streams.
				7. Electrical: Components factory wired for single point power connection. Control panel UL listed with access door.

Self-flashing curb does not have built-in cant strips.

* + - * 1. Roof Curb: [**8 inch**] [**12 inch**] [**16 inch**] [**20 inch**] [**24 inch**] [**<\_\_\_\_\_\_\_\_> inch**] high [**self-flashing**] of [**galvanized steel**] [**aluminum**] construction with continuously welded seams [**, built-in cant strips**] [**, 1 inch insulation and curb bottom**] [**, interior baffle with acoustic insulation, curb bottom**] [**, ventilated double wall**] [**, hinged curb adapter**], and factory installed nailer strip.

Edit the following to meet project requirements.

* + - * 1. Accessories:

Duct adapter for vertical discharge configuration.

Intake weather hood with 2 inch washable aluminum filters.

Exhaust weather hood with bird screen.

[**Gravity operated**] [**Motorized**] dampers factory installed [**and wired**] in supply and exhaust air streams.

Disconnect Switch: NEMA 250 [**Type 1**] [**Type 1, lockable**] [**Type 1, heavy duty**] [**Type 3R**] [**Type 4**] <**\_\_\_\_\_\_\_\_**> enclosure.

[**Spring**] [**Rubber-in-shear**] type vibration isolators.

Only use fan speed controller with direct drive fans.

Fan speed controller.

Edit the following to meet project requirements.

* + - * 1. Controls: Furnish unit with the following:

Dirty Filter Sensor: Activates warning light.

Rotation Sensor: Sends signal to remote indicator when wheel stops.

Economizer Mode: Stops wheel operation when outside air conditions approximate indoor air conditions. Furnish with [**temperature**] [**enthalpy**] sensor.

Frost Control: [**Unit on-off operation**] [**Exhaust fan only operation**] [**Pre-heat frost operation**].

Select the following paragraph and insert performance requirements for one or identical units. When specifying units of differing sizes, use schedule.

* + - * 1. Performance:

Exhaust Fan:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Supply Fan:

Air Flow: <**\_\_\_\_\_\_\_\_**> cfm.

Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Entering Air Conditions:

Supply Air - Summer:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Supply Air - Winter:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Exhaust Air - Summer:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Exhaust Air - Winter:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Leaving Air Conditions:

Summer:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Winter:

<**\_\_\_\_\_\_\_\_**> degrees F dry bulb.

<**\_\_\_\_\_\_\_\_**> degrees F wet bulb.

Recovery:

Summer:

Efficiency: <**\_\_\_\_\_\_\_\_**> percent.

Total Capacity: <**\_\_\_\_\_\_\_\_**> Btu/hr.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**> Btu/hr.

Winter:

Efficiency: <**\_\_\_\_\_\_\_\_**> percent.

Total Capacity: <**\_\_\_\_\_\_\_\_**> Btu/hr.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**> Btu/hr.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics:

Supply Fan: [**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

Exhaust Fan: [**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

Wheel: [**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Controls: <**\_\_\_\_\_\_\_\_**>.

1. EXECUTION
	* + 1. EXAMINATION
				1. Section 013000 - Administrative Requirements: Coordination and project conditions.
				2. Verify roof curbs are installed and dimensions are as [**shown on shop drawings**] [**instructed by manufacturer**].
			2. PREPARATION
				1. Furnish roof curbs to Section <**\_\_\_\_\_\_\_\_**> for installation.
			3. INSTALLATION
				1. Secure [**roof**] [**wall**] fans [**and**] [**gravity ventilators**] with [**cadmium plated steel**] [**aluminum**] [**stainless steel**] lag screws to [**roof curb**] [**structure**].
				2. Suspended [**Cabinet**] Fans: Install flexible connections specified in Section [**233300**] between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
				3. Install backdraft dampers on inlet to [**roof**] [**and**] [**wall**] exhaust fans [**and**] [**gravity ventilators used in relief air applications**].
				4. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
				5. Install safety screen where inlet or outlet is exposed.
				6. Pipe scroll drains to nearest floor drain.
				7. Install backdraft dampers on discharge of exhaust fans [**and as indicated on Drawings.**] [**Refer to Section 233300.**]
				8. Provide sheaves required for final air balance.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. MANUFACTURER'S FIELD SERVICES

Include the following based on Project conditions.

* + - * 1. Furnish services of factory trained representative for minimum of [**one**] <**\_\_\_\_\_\_\_\_**> days to start-up, calibrate controls, and instruct Director’s Representative on operation and maintenance.
			1. CLEANING
				1. Vacuum clean coils and inside of fan cabinet.
			2. DEMONSTRATION
				1. Demonstrate fan operation [**and maintenance procedures**].
			3. PROTECTION OF FINISHED WORK
				1. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.
			4. SCHEDULES

Include schedule when more than one unique fan or fan type is specified. Complete in conjunction with fan identification method used on drawings. No units of measurement are indicated; these may be added to schedule legend or included within each insert.

Consider the following examples when developing Project schedule.

* + - * 1. Centrifugal or Axial Fans:

F-1:

Location: <**\_\_\_\_\_\_\_\_**>.

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Fan Type: <**\_\_\_\_\_\_\_\_**>.

[**Hood/Housing: <\_\_\_\_\_\_\_\_>.**]

Wheel Type: <**\_\_\_\_\_\_\_\_**>.

Class: <**\_\_\_\_\_\_\_\_**>.

Arrangement: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Air Flow Capacity: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Drive: <**\_\_\_\_\_\_\_\_**>.

Motor Horsepower: <**\_\_\_\_\_\_\_\_**>.

Motor Speed: <**\_\_\_\_\_\_\_\_**>.

Fab Tip Speed: <**\_\_\_\_\_\_\_\_**>.

Outlet Velocity: <**\_\_\_\_\_\_\_\_**>.

Voltage: <**\_\_\_\_\_\_\_\_**>.

Sound: <**\_\_\_\_\_\_\_\_**> sones.

Discharge Sound Power:

1st Octave: <**\_\_\_\_\_\_\_\_**>.

2nd Octave: <**\_\_\_\_\_\_\_\_**>.

3rd Octave: <**\_\_\_\_\_\_\_\_**>.

4th Octave: <**\_\_\_\_\_\_\_\_**>.

5th Octave: <**\_\_\_\_\_\_\_\_**>.

6th Octave: <**\_\_\_\_\_\_\_\_**>.

7th Octave: <**\_\_\_\_\_\_\_\_**>.

8th Octave: <**\_\_\_\_\_\_\_\_**>.

Inlet Sound Power:

1st Octave: <**\_\_\_\_\_\_\_\_**>.

2nd Octave: <**\_\_\_\_\_\_\_\_**>.

3rd Octave: <**\_\_\_\_\_\_\_\_**>.

4th Octave: <**\_\_\_\_\_\_\_\_**>.

5th Octave: <**\_\_\_\_\_\_\_\_**>.

6th Octave: <**\_\_\_\_\_\_\_\_**>.

7th Octave: <**\_\_\_\_\_\_\_\_**>.

8th Octave: <**\_\_\_\_\_\_\_\_**>.

Curb Size: <**\_\_\_\_\_\_\_\_**>.

Damper Size: <**\_\_\_\_\_\_\_\_**>.

Weight: <**\_\_\_\_\_\_\_\_**>.

F-2:

Location: <**\_\_\_\_\_\_\_\_**>.

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Fan Type: <**\_\_\_\_\_\_\_\_**>.

[**Hood/Housing: <\_\_\_\_\_\_\_\_>.**]

Wheel Type: <**\_\_\_\_\_\_\_\_**>.

Class: <**\_\_\_\_\_\_\_\_**>.

Arrangement: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Air Flow Capacity: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Drive: <**\_\_\_\_\_\_\_\_**>.

Motor Horsepower: <**\_\_\_\_\_\_\_\_**>.

Motor Speed: <**\_\_\_\_\_\_\_\_**>.

Fab Tip Speed: <**\_\_\_\_\_\_\_\_**>.

Outlet Velocity: <**\_\_\_\_\_\_\_\_**>.

Voltage: <**\_\_\_\_\_\_\_\_**>.

Sound: <**\_\_\_\_\_\_\_\_**> sones.

Discharge Sound Power:

1st Octave: <**\_\_\_\_\_\_\_\_**>.

2nd Octave: <**\_\_\_\_\_\_\_\_**>.

3rd Octave: <**\_\_\_\_\_\_\_\_**>.

4th Octave: <**\_\_\_\_\_\_\_\_**>.

5th Octave: <**\_\_\_\_\_\_\_\_**>.

6th Octave: <**\_\_\_\_\_\_\_\_**>.

7th Octave: <**\_\_\_\_\_\_\_\_**>.

8th Octave: <**\_\_\_\_\_\_\_\_**>.

Inlet Sound Power:

1st Octave: <**\_\_\_\_\_\_\_\_**>.

2nd Octave: <**\_\_\_\_\_\_\_\_**>.

3rd Octave: <**\_\_\_\_\_\_\_\_**>.

4th Octave: <**\_\_\_\_\_\_\_\_**>.

5th Octave: <**\_\_\_\_\_\_\_\_**>.

6th Octave: <**\_\_\_\_\_\_\_\_**>.

7th Octave: <**\_\_\_\_\_\_\_\_**>.

8th Octave: <**\_\_\_\_\_\_\_\_**>.

Curb Size: <**\_\_\_\_\_\_\_\_**>.

Damper Size: <**\_\_\_\_\_\_\_\_**>.

Weight: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Gravity Roof Ventilator:

GV-1:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Application: <**\_\_\_\_\_\_\_\_**>.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Pressure Drop: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Throat Area: <**\_\_\_\_\_\_\_\_**>.

Weight: <**\_\_\_\_\_\_\_\_**>.

GV-2:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Application: <**\_\_\_\_\_\_\_\_**>.

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Pressure Drop: <**\_\_\_\_\_\_\_\_**>.

Size: <**\_\_\_\_\_\_\_\_**>.

Throat Area: <**\_\_\_\_\_\_\_\_**>.

Weight: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Energy Recovery Ventilator:

ERV-1:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Service: <**\_\_\_\_\_\_\_\_**>.

Exhaust Fan:

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Supply Fan:

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Entering Air Conditions: <**\_\_\_\_\_\_\_\_**>.

Supply Air - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Supply Air - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Exhaust Air - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Exhaust Air - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Leaving Air Conditions - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Leaving Air Conditions - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Recovery: <**\_\_\_\_\_\_\_\_**>.

Summer:

Efficiency: <**\_\_\_\_\_\_\_\_**>.

Total Capacity: <**\_\_\_\_\_\_\_\_**>.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**>.

Winter:

Efficiency: <**\_\_\_\_\_\_\_\_**>.

Total Capacity: <**\_\_\_\_\_\_\_\_**>.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**>.

Motor Horsepower: <**\_\_\_\_\_\_\_\_**>.

Supply Fan: <**\_\_\_\_\_\_\_\_**>.

Exhaust Fan: <**\_\_\_\_\_\_\_\_**>.

Wheel: <**\_\_\_\_\_\_\_\_**>.

Voltage: <**\_\_\_\_\_\_\_\_**>.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

ERV-1:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Service: <**\_\_\_\_\_\_\_\_**>.

Exhaust Fan:

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Supply Fan:

Air Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Static Pressure: <**\_\_\_\_\_\_\_\_**>.

Fan RPM: <**\_\_\_\_\_\_\_\_**>.

Entering Air Conditions: <**\_\_\_\_\_\_\_\_**>.

Supply Air - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Supply Air - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Exhaust Air - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Exhaust Air - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Leaving Air Conditions - Summer:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Leaving Air Conditions - Winter:

Dry Bulb: <**\_\_\_\_\_\_\_\_**>.

Wet Bulb: <**\_\_\_\_\_\_\_\_**>.

Recovery: <**\_\_\_\_\_\_\_\_**>.

Summer:

Efficiency: <**\_\_\_\_\_\_\_\_**>.

Total Capacity: <**\_\_\_\_\_\_\_\_**>.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**>.

Winter:

Efficiency: <**\_\_\_\_\_\_\_\_**>.

Total Capacity: <**\_\_\_\_\_\_\_\_**>.

Sensible Capacity: <**\_\_\_\_\_\_\_\_**>.

Motor Horsepower: <**\_\_\_\_\_\_\_\_**>.

Supply Fan: <**\_\_\_\_\_\_\_\_**>.

Exhaust Fan: <**\_\_\_\_\_\_\_\_**>.

Wheel: <**\_\_\_\_\_\_\_\_**>.

Voltage: <**\_\_\_\_\_\_\_\_**>.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 233400