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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ |
| 3 | March 21. 2011 | Minor edits |
| 4 | December 15, 2014 | First draft review (AV) |
| 5 | June 8, 2015 | Second Draft for Review (AV) |
| **6** | **September 16, 2015** | **Updated, Finalized Specification – Reference eDOCS #5823634-v6 (AV)** |
| 7 | June 6, 2017 | Updated references to standards ANSI/AMCA 99-16, ANSI/AMCA 210-16, ANSI/AMCA 300-14, ABMA 9-2015, ANSI/ASA S2.19-1999 (R2004), ASTM B117-16, ASTM D2247-15, ASTM D4167-15, ASTM E84-16, NEMA MG 1-2016 **(AAM)** |
| 8 | August 17, 2017 | Updated listed products. Those that were removed were replaced with performance specifications and standards.(CPD PMO, OMM) |
| 9 | December 7, 2017 | Updated References to Design Guideline Section 35 (AAM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

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**The on-line copy is the current version of the document.**

# GEneral

* 1. Related Sections

*[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

*Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

*Contractor is responsible for coordination of the Work.*

*This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the Section for the specific project, it may be deleted.]*

*[List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

*[List Sections specifying products installed but not supplied under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

[List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 01425 – Computerized Maintenance Management System Data Requirements

#### Section 01430 – Operation and Maintenance Data

#### Section 01600 – Material and Equipment

#### Section 01640 – Manufacturer’s Services

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 09900 – Painting and Protective Coatings

#### Section 15080 – Process Piping Insulation

#### Section 15810 – Metal Ductwork and Accessories

#### Section 15950 – HVAC Systems Testing, Adjusting and Balancing

#### Section 16222 – Motors: 1 to 200 kW, 575V

#### Design Guideline Section 35 – Development and Maintenance of Asset Inventory and Tagging.

## References

[Delete .1 if Section 01060 – Regulatory Requirements is included in Contract Documents.]

### Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

#### Air-Conditioning, Heating, & Refrigeration Institute (AHRI).

##### *[Consultant to add relevant standards from AHRI]*

#### Air Movement and Control Association International (AMCA):

##### ANSI/AMCA 99-16, Standards Handbook.

##### ANSI/AMCA 201-02 (R2011), Fans and Systems.

##### ANSI/AMCA 203-90 (R2011), Field Performance Measurement of Fan Systems.

##### ANSI/AMCA 210-16, Laboratory Methods of Testing Fans for Certified Aerodynamic.

##### ANSI/AMCA 300-14, Reverberant Room Method for Sound Testing of Fans.

##### ANSI/AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

#### American Bearing Manufacturers Association (ABMA):

##### ABMA 9-2015, Load Ratings and Fatigue Life for Ball Bearings.

#### Acoustical Society of America (ANSI/ASA)

##### ANSI/ASA S2.19-1999 (R2004), Mechanical Vibration—Balance Quality Requirements of Rigid Rotors—Part 1, Determination of Permissible Residual Unbalance, Including Marine Applications.

#### American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

##### 2011 ASHRAE Handbook - HVAC Applications .

#### ASTM International (ASTM):

##### ASTM B117-16, Standard Practice for Operating Salt Spray (Fog) Apparatus.

##### ASTM D2247-15, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

##### ASTM D2794-93 (2010), Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

##### ASTM D3363-05 (2011)e2, Standard Test Method for Film Hardness by Pencil Test.

##### ASTM D4167-15 Standard Specification for Fiber-Reinforced Plastic Fans and Blowers.

##### ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.

#### National Electrical Manufacturers Association (NEMA):

##### NEMA MG 1-2016, Motors and Generators. NEMA enclosures *[Consultant to add details]*

#### National Fire Protection Association (NFPA):

##### NFPA 45, 2015 Edition, Standard on Fire Protection for Laboratories Using Chemicals.

#### Occupational Health and Safety Act (OHSA).

#### Society for Protective Coatings (SSPC):

##### SSPC-SP 3, Power Tool Cleaning.

##### SSPC-SP 5/NACE No. 1, White Metal Blast Cleaning.

##### SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.

##### SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.

#### Underwriters Laboratories Inc. (UL/ULC):

##### UL 507, Electric Fans.

## Definitions

### The following is a list of abbreviations which may be used in this Section:

#### AC: Alternating Current.

#### CISD: Chemical Industry, Severe-Duty.

#### dB: Decibel.

#### DWDI: Double Width, Double Inlet.

#### FRP: Fibreglass Reinforced Plastic.

#### hp: Horsepower.

#### ODP: Open Drip Proof.

#### SWSI: Single Width, Single Inlet.

#### TEFC: Totally Enclosed, Fan Cooled.

#### UV: Ultra Violet

#### XP: Explosion Proof.

## Submittals

### Action Submittals, in accordance with Section 01300 - Submittals:

#### Provide for all Products specified, as follows:

##### Identification as referenced in Contract Documents.

##### Manufacturer’s name and model number

##### Descriptive specifications, literature and drawings

##### Dimensions and weights

##### Fan sound power level data (reference 10 to power minus 12 Watts) at design operating point.

##### Fan Curves:

###### Performance Curves Indicating:

Relationship of flow rate to static pressure for various fan speeds.

Brake horsepower curves.

Acceptable selection range (surge curves, maximum revolutions per minute, etc).

Static pressure, capacity, horsepower demand and overall efficiency required at the duty point, including drive losses.

###### For variable air volume applications, indicate operating points at 100, 80, 60 and 40 percent of design capacity on fan curves including data to indicate effect of capacity control devices such as inlet vanes on flow, pressure and brake horsepower.

##### Capacities and ratings.

##### Construction materials.

##### Fan type, size, class, drive arrangement, discharge, rotation and bearings.

##### Wheel type, diameter, revolutions per minute, and tip speed.

##### Motor data.

##### Power and control wiring diagrams, including terminals and numbers.

##### Vibration isolation.

##### Factory finish system.

##### Colour selection charts where applicable.

##### [Corrosion protection coating Product data.]

##### [Fibreglass Material: Statement of resins and reinforcing proposed for use.]

#### “Or Equal” Equipment:

##### Where submitted equipment results in change to fan inlet or outlet ductwork configuration shown on the Drawings, submit system effect factor calculations indicating increased static pressure requirements as described in ANSI/AMCA 201-02 (R2011).

##### Where submitted equipment results in change to ductwork and equipment configuration shown on the Drawings, submit detailed information on structural, mechanical, electrical, or other modifications necessary to adapt arrangement to the equipment furnished.

### Informational Submittals, in accordance with Section 01300 - Submittals:

#### Recommended procedures for the protection and handling of Products prior to installation.

#### Manufacturer’s installation instructions.

#### Manufacturer’s Certificate of Compliance in accordance with Section 01640 - Manufacturers’ Services, for the following:

##### Motors specified to be premium efficient type.

##### FRP fans.

#### Test reports.

#### Operation and maintenance data in conformance with Section 01430 - Operation and Maintenance Data. Include as-built version of equipment schedules.

#### All equipment to conform to the Region’s Tagging Standard in accordance with Design Guideline Section 35 – Development and Maintenance of Asset Inventory and Tagging.

#### All equipment information shall be provided in accordance with Section 01425 - Computerized Maintenance Management System Data Requirements.

## Quality Assurance

### Performance Ratings: Tested in accordance with ANSI/AMCA 210-16.

### Sound Ratings: Tested in accordance with ANSI/AMCA 300-14.

### Fabrication: In accordance with ANSI/AMCA 99-16.

## Extra Materials

### Furnish, tag, and box for shipment and storage the following [spare parts,] [special tools,] [and] [materials:]

|  |  |
| --- | --- |
| Item | Quantity |
| Vee Belts | **[One] [     ]** complete set per unit |
| **[     ]** | **[One] [     ]** complete sets **[per unit]** |
| **[Special tools required to maintain or dismantle]** | **[One] [     ]** complete set **[for each different size unit]** |

### Delivery: In accordance with Section 01600 - Material and Equipment.

# PRODUCTS

## Equipment Schedules

### Some specific equipment requirements are listed in the Equipment Schedules, on the Contract Drawings.

## Spark Resistant Construction

### Fans required to be spark resistant shall comply with requirements of ANSI/AMCA 99-16 ,0401. *[Consultant to confirm reference detail]*

## Nameplates

### All units shall include a factory installed permanently attached nameplate displaying the unit model and serial number.

## Operating Limits

### Fans designated to meet a specified fan class shall comply with the requirements of ANSI/AMCA 99-16, 2408 69. *[Consultant to confirm reference detail]*

## Acoustical Levels

### Equipment selections shall produce sound power levels in each octave band no greater than shown in the Equipment Schedule.

## Drives

### Furnish multiple drive belts where motor horsepower is 1.5 kW or larger.

### Drive assembly shall be sized for a minimum 140 percent of fan motor horsepower rating.

### Sheaves shall be capable of providing 150 percent of motor horsepower.

### Fan Shafts: First critical speed of at least 125 percent of fan maximum operating speed.

### Furnish motors for V belt drives with adjustable rails or bases.

### Unless otherwise noted, furnish belt-driven fans with cast iron or flanged steel sheaves.

### Motors 15 kW or Smaller:

#### Variable pitch V belt sheaves allowing a minimum of 20 percent speed variation.

#### Final operating point shall be at approximate sheave midpoint.

### Motors Larger than 15 kW: Fixed-pitch sheaves.

### Drive Adjustment:

#### When fixed-pitch sheaves are furnished, accomplish system air balancing by either trial of different fixed-pitch sheaves or use of temporary adjustable-pitch sheaves.

#### Provide trial and final sheaves, as well as drive belts, as required.

### Weather Cover: For outdoor applications, factory fabricated drive assembly of same material as fan housing, unless otherwise specified in the Contract Documents.

### Belt and Shaft Guards:

#### Easily removable and to enclose entire drive assembly, meeting all applicable federal and provincial requirements, *[Consultant to add relevant federal and provincial requirements as applicable]* including those specified in the OHSA.

#### Guard faces of expanded metal having a minimum of 60 percent free area for ventilation.

#### Bright yellow finish.

### Provide speed test openings at shaft locations.

## Finishes

### Carbon Steel Parts: Factory finish as follows, unless otherwise indicated in the Contract Documents.

#### Parts cleaned and chemically pretreated with a phosphatizing process.

#### Alkyd enamel primer.

#### Air-dry enamel topcoat.

### Aluminum Parts: Finished smooth and left unpainted, unless otherwise stated in the Contract Documents.

### Stainless Steel Parts: Finished smooth and left unpainted.

### Fibreglass Parts: Finished in accordance with *[Consultant to provide details]*, fibreglass material.

## Cabinet Ceiling Fan

### General:

#### Factory-assembled, ceiling, wall or inline mounted, centrifugal cabinet fan; including housing, fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housing:

#### Material: Minimum 20 gauge galvanized steel.

#### Construction:

##### Minimum 14 gauge blower and motor support frame.

##### Lined with minimum 12 mm acoustical insulation.

##### Outlet duct collar with integral reinforced aluminum backdraft damper, with nylon bushings.

##### Motor mounted on resilient vibration isolators.

##### Motor and blower removable from unit without cabinet disassembly.

##### Removable cabinet access panels.

##### Air Inlet: Field convertible for bottom or end air inlet configuration.

##### Predrilled universal mounting brackets, adjustable.

### Wheel: Centrifugal forward curved type, galvanized steel or plastic construction.

### Shaft, Bearings, Drive:

#### Shafts: Turned, ground and polished carbon steel.

#### Bearings: Grease lubricated, precision antifriction ball, sealed type.

#### Drives:

##### In accordance with *[Consultant to provide details]*.

##### Factory set to the specified fan revolutions per minute.

##### Type: Direct.

### Electrical:

#### Integral wiring box.

#### Factory-installed disconnect receptacle.

### Accessories: Provide [ as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements . *[Consultant to ensure Equipment Schedule is provided and updated.]*] [as follows:]

#### Ceiling Grille: Factory fabricated, [steel] [aluminum]construction, white baked enamel finish.

#### Speed Controller:

##### Wall mount.

##### Solid state electronics.

##### Dial type combination ON/OFF switch and SPEED selector.

#### Filter Box:

##### Attached to fan inlet.

##### Box construction to match fan housing.

##### Integral duct collars.

##### Filter Media: 25 mm [aluminum wire mesh] [pleated disposable type].

### Certifications

#### UL listed for Canada

#### Bears the ACMA seal for sound and air

#### ISO - 9001 certificate

## Ceiling Fan, Industrial

### General:

#### Factory-assembled paddle-type ceiling fan, propeller, motor and accessories.

#### Fans with motor speed control labeled in accordance with UL 507.

#### Warranty: 3 year duration, full coverage against manufacturer’s defects.

### Construction:

#### Industrial grade construction, with cast-iron yoke and cast-iron motor housing.

#### Blades: Aerodynamically curved, aluminum.

#### Finish: Baked white enamel.

#### Downrod:

##### Minimum 250 mm length, other lengths as required to provide specified installation height; use factory provided extender kit where necessary.

##### 20 mm nominal diameter.

#### Secondary Support: Factory-installed, minimum 1.8 metre-long, 3 mm-diameter galvanized steel cable, minimum 771-kg breaking strength.

#### Motor:

##### Direct drive, permanent split-capacitor type, reversible.

##### Permanently sealed ball bearings.

##### Moisture and dust resistant.

##### Thermal-overload: Built-in, self-resetting.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements *[Consultant to ensure Equipment Schedule is provided and updated.]*] [as follows:]

#### Speed Controller:

##### Wall mount.

##### Solid state electronics.

##### Suitable for single and multiple fan operation.

##### Dial type combination ON/OFF switch and SPEED selector.

#### Fan Blade Guard:

##### Factory fabricated, spiral wire configuration, chrome plated steel.

##### Full blade coverage.

## Inline Fan, Centrifugal, Square

### General:

#### Factory-assembled, centrifugal, inline fan, square housing configuration; including housing, fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housing:

#### Construction: [Minimum 18 gauge galvanized steel.] [All aluminum.]

#### Integral duct collars.

#### Removable side panels, for ease of service.

#### Field convertible for side air discharge configuration.

#### Predrilled universal mounting brackets for vertical or horizontal installation.

#### Inlets: Aerodynamic aluminum venturi.

#### Corrosion-resistant fasteners.

#### Drive belt and bearings separated from air steam by enclosure.

### Wheel:

#### Centrifugal backward inclined, 100 percent aluminum construction.

#### Precision machined cast aluminum hub.

#### Die-formed airfoil or backward inclined blades.

#### Matched to inlet venturi.

#### Attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished carbon steel.

##### Keyed for sheave installation.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning, pillow block style, re-lubricable or sealed type.

##### Selected for average life (ABMA 9, average life L50) of a minimum of 200,000 hours operation at maximum cataloged operating speed.

#### Drives:

##### [Consultant to provide specification details on Drives]

##### Factory set to the specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule.] [Belt.] [Direct.]

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 9.] [Arrangement 10.] [Arrangement 4.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Belt Guard: Sheet metal construction, compliant with OHSA .

#### Motor and Drive Cover:

##### Factory fabricated, OHSA type.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

##### Fan speed controller.

#### Gravity Backdraft Damper: Galvanized steel frame, aluminum blades, brass pivot pins, neoprene seals on damper blade edges, gravity operation, and adjustable counterweight.

#### Motorized Damper: Galvanized steel frame, aluminum blades, neoprene seals on damper blade edges, [120V] [12V]operator.

#### Insulated Housing: Fibreglass insulation, 25 mm-thick, [neoprene coated,] [foil faced,] on interior of housing.

#### Filter Box:

##### Attached to fan inlet.

##### Box construction to match fan housing.

##### Integral duct collars.

##### Removable side panels.

##### Filter Media: 50 mm [aluminum wire mesh] [pleated disposable type].

#### Inlet Screen: Removable 25 mm mesh screen, aluminum construction, overexposed inlets.

#### Disconnect: Factory installed, non-fused, NEMA [1] [4X] *[Consultant to provide details on Disconnect].*

#### Single Side Discharge: Package consisting of side duct connection collar and rear-discharge blank-off panel.

#### Dual Side Discharge: Package consisting of side duct connection collars and rear-discharge blank-off panel.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Terminate with zerk fittings.

#### Spark Resistant Construction Classification: ANSI/AMCA 99-16 0401 Type[A] [B] [C] *[Consultant to provide details on classification]*

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel.

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating. [*Consultant to ensure details are in the Contract Documents]*]

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings]

### Required Certifications:

#### UL listed for Canada

#### ACMA seal for sound and air

## Inline Fan, Tubular Centrifugal

### General:

#### Factory-assembled tubular centrifugal fan, belt drive; including housing, fan wheel, drive assembly, motor and accessories.

#### Fan Performance: ANSI/ AMCA 99-16 2408 Class [I] [II] [III] [as detailed in the Contract Documents. *[Consultant to ensure details are in the Contract Documents]].*

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

#### UL listed for Canada.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Air straightening vanes at fan outlet, integral with shaft, bearing support, and outer casing, fully welded.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets, welded to housing, as required for indicated fan arrangement.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Inlets: Die-formed bell mouth, matched to fan wheel inlet shroud.

#### Motor Base Plate: Minimum of 4.7 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Material: [Steel] [Aluminum]construction.

#### Centrifugal, one-piece, non-overloading, backwardly inclined blades.

#### Blades continuously welded to inlet shroud and back-plate.

#### Attached to fan shaft with split taper lock bushing.

### Shafts, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Document details pertaining to Drives. *[Consultant to add details]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 1.] [Arrangement 4.] [Arrangement 9.] [Vertical.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule.] [as follows:]

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Belt Guard: Sheet metal construction, OHSA compliant.

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: [Elastomeric.] [Ceramic felt.] [Lubricated.] Stuffing box.] [Type as scheduled – refer to subsection 3.7 Supplements.]

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Outlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Support Base: Welded metal, for standard platform or floor mounting.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] *[Consultant to provide details on construction]*

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel.

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

#### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with [Consultant to provide details on corrosion protection] Corrosion Protection Coating.]

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Inline Fan, Tubular Centrifugal Fibreglass

### General:

#### Factory-assembled tubular centrifugal fan, fibreglass construction, belt drive; including housing, fan wheel, drive assembly, motor and accessories.

#### Fibreglass Construction: In accordance with ASTM D4167-97 (2007).

#### Fan Performance: ANSI/AMCA 99-16 2408 Class [I] [II] [III] [as scheduled].

#### Air Stream Hardware: Type 316 stainless steel.

### Fibreglass Material:

#### Construction: Resin reinforced fibre cloth and mat.

#### Resin:

##### [Polyester] [Vinyl ester] thermosetting resin.

##### Selected by fabricator, subject to approval by Consultant.

##### Suitable for intended service with no fillers or thixotropic agents.

##### Premium grade and corrosion resistant.

##### Structural wall resin may be of different chemical resistance, subject to conditions of service and approval by Consultant.

##### [Flame Spread Index:

###### ASTM E84-16, less than 25; fire retardant additives used only in structural layer.

###### Structural wall resin shall contain a minimum of 3 percent antimony trioxide to achieve required flame spread index.]

##### For outdoor locations, add ultraviolet absorbers to surfacing resin to improve weather resistance.

##### For interior locations, final coat shall be factory applied intumescent coating to achieve designated results for low smoke development.

##### Colour:

###### Use no dyes, pigments, or colourants [except in exterior gel coat].

###### Exterior gel coat shall be [white] [ ].

### Reinforcement:

##### Veil: Chemical surfacing mat, [Type C (chemical) glass veil] [Nexus Surface Veil] [carbon veil].

##### Chopped Strand Mat: Type E glass, minimum 4.8 Pa per square foot, with silane finish and styrene soluble binder.

##### Continuous Roving for Chopper Gun Spray-Up: Type E glass.

##### Woven Roving: Type E glass, nominal 8.1 Pa, 4 by 5 weave, with silane type finish.

#### Laminate:

##### Inner Surface (Veil):

###### Resin rich, veil reinforced, 10 mils to 20 mils thick.

###### Use no additives.

###### Finish and binder compatible with lay-up resin.

###### Reinforcement Content: Maximum of 20 percent.

##### Interior (Corrosion) Layer:

###### Resin rich, at least two plies of chopped strand mat, nominal 100 mils to 120 mils thick.

###### Use no additives.

###### Construct interior layer of resin reinforced with at least two plies of chopped strand mat backing the veil.

###### Reinforcement Content: 25 plus or minus 5 percent.

##### Exterior (Structural) Layer:

###### Resin with mat, cloth, woven roving or chopped strand glass reinforcement.

###### Enough resin present to prevent surface fibre show.

###### Exterior surface relatively smooth, with no exposed fibres or sharp projections.

##### Wall Thickness: As required for equipment structural integrity, minimum of 4.8 mm.

### Housing:

#### Material: Fibreglass construction.

#### Construction:

##### Tubular housing shell.

##### Integral predrilled duct connection flanges to ensure housing concentricity and housing strength.

##### Air straightening vanes, fibreglass construction, at fan outlet, interconnected with inner and outer shell.

##### Bearing Base and Drive Enclosure:

###### Bearings and belts enclosed in air insulated fibreglass housing for protection from air stream gases, fumes, and vapors.

###### Supported by tapered gussets interlocked into outer housing.

###### Constructed of laminated glass and resin.

###### Bearing housing furnished with a bolted, removable Teflon shaft closure plate to facilitate bearing access.

###### Viton shaft seal.

##### Lifting lugs, steel, bolted to fan housing flanges.

##### Mounting brackets, steel, bolted to fan housing flanges, as required for indicated fan arrangement.

#### Inlet:

##### Bolted, removable.

##### Streamlined, bell mouth type

##### Fibreglass construction.

##### Matched to fan wheel inlet shroud.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminated with zerk fittings.

#### Motor Base Plate:

##### Minimum 4.8 mm steel plate.

##### Bolted between gussets integral to fan housing flanges.

##### Provision for belt tensioning and adjustment.

### Wheel:

#### Material: Fibreglass construction.

#### Centrifugal, one-piece, non-overloading, backwardly inclined airfoil blades.

#### Mechanically fastened to end of fan shaft by Type 316 stainless steel bolt.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished Type 316 stainless steel.

##### Keyed for sheave installation.

#### Bearings:

##### Grease lubricated, precision antifriction, ball self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement:[As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 1.] [Arrangement 4.] [ Arrangement 9.] [Vertical.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Housing Access Doors: Fibreglass construction, bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Fibreglass construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Belt Guard: Sheet metal construction, OHSA compliant.

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: [Elastomeric.] [Ceramic felt.] [Lubricated.] [Stuffing box.] [Type as scheduled – refer to subsection 3.7 Supplements.]

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Outlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Nameplates: Type 316 stainless steel manufacturer’s nameplates.

#### Support Base: Welded metal, for standard platform or floor mounting.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] *[Consultant to provide details on construction]*

#### Corrosive Service Metal Components:

##### Metal components including the fan shaft, motor pedestal, motor slide base, lube lines, accessories, hardware etc, shall be Type 316 stainless steel.

##### Coated steel components will not be accepted.

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components: Steel components.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with [[Consultant to provide details on corrosion protection and coating. Corrosion Protection Coating.]

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Inline Fan, Tube Axial

### General:

#### Factory-assembled tube-axial fan, belt drive; including housing, fixed pitch fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets, welded to housing, as required for indicated fan arrangement.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Motor Base Plate: Minimum of 4.8 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Hub: Cast aluminum.

#### Blades: Cast aluminum airfoil design.

#### Wheel assembly attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### *[Consultant to provide additional required details]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 1.] [Arrangement 4.] [Arrangement 9.] [Vertical.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Belt Guard: Sheet metal construction, OHSA complaint.

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: Elastomeric.

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Outlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Inlet Bell: Factory fabricated aerodynamic bell, bolted to fan inlet, same material as fan housing.

#### Inlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Outlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Support Base: Welded metal, for standard platform or floor mounting.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel (or propeller).

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents, Corrosion Protection Coating.] *[Consultant to ensure such details are added to Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Inline Fan, Vane Axial

### General:

#### Factory-assembled vane-axial fan, belt drive; including housing with integral vanes, adjustable pitch fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Air straightening vanes at propeller discharge, integral with housing, fully welded.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets, welded to housing, as required for indicated fan arrangement.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Motor Base Plate: Minimum of 4.8 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Hub:

##### Cast aluminum.

##### Streamlined hub cover.

#### Blades:

##### Cast aluminum

##### Adjustable pitch.

##### Factory set to required pitch.

##### Blade angle field adjustable.

#### Wheel assembly attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 1.] [Arrangement 4.] [Arrangement 9.] [Vertical.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory-installed, non-fused, NEMA [3R] [4X].

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Belt Guard: Sheet metal construction, OHSA compliant.

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: Elastomeric.

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Outlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Inlet Bell: Factory fabricated aerodynamic bell, bolted to fan inlet, same material as fan housing.

#### Inlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Outlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Support Base: Welded metal, for standard platform or floor mounting.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel (or propeller).

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents, Corrosion Protection Coating.]*[ Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Roof Fan, Centrifugal Up-blast

### General:

#### Factory-assembled centrifugal up-blast roof fan; including housing, fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housing:

#### Construction: Spun-formed aluminum, minimum 16 gauge marine alloy.

#### Windband: Finish with rolled bead.

#### Top Cap: Motor access via quick release latches.

#### Motor completely sealed from exhaust air stream.

#### Motor cooling via air breather tubes.

#### Integral conduit chase for wiring.

#### Drain trough at lowest point of housing.

#### Fan Inlet:

##### Full inlet cone of aluminum construction.

##### Match inlet shroud.

### Wheel:

#### Aluminum construction, backward inclined centrifugal, non-overloading type.

#### Machined, cast aluminum hub.

#### Matched to deep spun inlet venturi.

### Shaft, Bearings, Drive:

#### Shaft:

##### Turned, ground and polished carbon steel.

##### Keyed for sheave installation.

##### Zinc-phosphate coated and oil emulsion-dipped.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning, pillow block style.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Terminate with zerk fittings.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such are in the Contract Documents]*

##### Factory set to specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Belt.] [Direct.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Gravity Backdraft Damper: Gravity operation, adjustable counterweight, and aluminum construction.

#### Motorized Damper: Aluminum frame, aluminum blades, aluminum hinge pins with nylon bushings, [120V] [12V] operator.

#### Bird Screens: Aluminum construction.

#### Roof Curb:

##### Factory fabricated, [galvanized steel] [aluminum]construction.

##### [With] [Without] damper tray.

##### Sloped to match roof pitch, and to provide level top.

##### Height Above Finished Roof: [300 mm.] [As scheduled – refer to subsection 3.7 Supplements.]

##### Mitered continuous welded corner seams.

##### Pressure-treated wood nailer.

##### Insulation: Minimum 38 mm thick, 48 kg per cubic metre density, rigid mineral fibreboard insulation with metal liner.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X] [as scheduled].

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Spark Resistant Construction Classification: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel.

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating. *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Roof Fan, Tube Axial

### General:

#### Factory-assembled tube-axial fan, roof mounted, belt drive; including housing, fixed pitch fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets, welded to housing, as required for indicated fan arrangement.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Motor Base Plate: Minimum of 4.8 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Hub: Cast aluminum.

#### Blades: Cast aluminum airfoil design.

#### Wheel assembly attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

### Bearings:

#### Grease lubricated, precision antifriction ball, self-aligning type.

#### Mounted in cast iron pillow block housing.

#### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

#### Suitable for fan operation in vertical configuration.

### Drives:

#### In accordance with Contract Documents pertaining to Drives*. [Consultant to provide details and ensure such details are in the Contract Documents]*

#### Factory set to the specified fan revolutions per minute.

#### Type: Belt.

#### Arrangement: Vertical, [Arrangement 9].*[Consultant to provide details]*

#### Belts: Oil and heat resistant, non-static type.

### Roof Mount Accessories:

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Stack Cap:

##### Factory fabricated.

##### Same material as fan housing.

##### Integral backdraft dampers.

#### Curb Base:

##### Factory fabricated.

##### Sized to adapts fan inlet to roof curb.

##### Same material as fan housing.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Roof Curb:

##### Factory fabricated.

##### [With] [Without]damper tray.

##### Sloped to match roof pitch and to provide level top.

##### Height Above Finished Roof: [300 mm.] [As scheduled.]

##### [Galvanized steel] [Aluminum] construction.

##### Mitered continuous welded corner seams.

##### Pressure-treated wood nailer.

##### Insulation: Minimum 38 mm thick, 48 kg per cubic metre density, rigid mineral fibreboard insulation with metal liner.

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: Elastomeric.

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Inlet Bell: Factory fabricated aerodynamic bell, bolted to fan inlet, same material as fan housing.

#### Inlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel (or propeller).

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Roof Fan, Tubular Centrifugal

### General:

#### Factory-assembled tubular centrifugal fan, roof mounted, belt drive; including housing, fan wheel, drive assembly, motor and accessories.

#### Fan Performance: ANSI/AMCA 99-16 2408 Class [I] [II] [III] [as scheduled].

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Air straightening vanes at fan outlet, integral with shaft, bearing support, and outer casing, fully welded.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets, welded to housing, as required for indicated fan arrangement.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Inlets: Die-formed bell mouth, matched to fan wheel inlet shroud.

#### Motor Base Plate: Minimum of 4.8 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Material: [Steel] [Aluminum] construction.

#### Centrifugal, one-piece, non-overloading, backwardly inclined blades.

#### Blades continuously welded to inlet shroud and back-plate.

#### Attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement: Vertical, Arrangement 9. *[Consultant to provide details]*

##### Belts: Oil and heat resistant, non-static type.

### Roof Mount Accessories:

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Stack Cap:

##### Factory fabricated.

##### Same material as fan housing.

##### Integral backdraft dampers.

#### Curb Base:

##### Factory fabricated.

##### Sized to adapts fan inlet to roof curb.

##### Same material as fan housing.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### 1. Roof Curb:

##### Factory fabricated.

##### [With] [Without] damper tray.

##### Sloped to match roof pitch, and to provide level top.

##### Height Above Finished Roof: [300 mm.] [As scheduled – refer to subsection 3.7 Supplements.]

##### [Galvanized steel] [Aluminum]construction.

##### Mitered, continuous welded corner seams.

##### Pressure-treated wood nailer.

##### Insulation: Minimum 38 mm thick, 48 kg per cubic metre density, rigid mineral fibreboard insulation with metal liner.

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: [Elastomeric.] [Ceramic felt.] [Lubricated.] [Stuffing box.] [Type as scheduled – refer to subsection 3.7 Supplements.]

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel (or propeller).

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to , Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Roof Fan, Vane Axial

### General:

#### Factory-assembled vane-axial fan, roof-mounted, belt drive; including housing with integral vanes, adjustable pitch fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housings:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Heavy gauge rolled metal casing, with continuous seam welding.

##### Air straightening vanes at propeller discharge, integral with housing, fully welded.

##### Bearing and drive components isolated from air stream within continuously welded tunnel.

##### Lifting lugs welded to housing.

##### Mounting brackets welded to housing as required for the fan arrangement indicated on the Drawings.

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Motor Base Plate: Minimum of 3.8 mm metal plate, welded to fan housing, to provide belt tensioning and adjustment.

#### Duct Flanges: Angle ring flanges, same diameter as housing, at fan inlet and outlet, heavy construction, factory drilled.

### Wheel:

#### Hub:

##### Cast aluminum.

##### Streamlined hub cover.

#### Blades:

##### Cast aluminum

##### Adjustable pitch.

##### Factory set to required pitch.

##### Blade angle field adjustable.

#### Wheel assembly attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished hot-rolled carbon steel.

##### Keyed for sheave installation.

##### Corrosion protection coating.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Suitable for fan operation in vertical configuration.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: Belt.

##### Arrangement: Vertical, Arrangement 9. *[Consultant to provide details]*

##### Belts: Oil and heat resistant, non-static type.

### Roof Mount Accessories:

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Stack Cap:

##### Factory fabricated.

##### Same material as fan housing.

##### Integral backdraft dampers.

#### Curb Base:

##### Factory fabricated.

##### Sized to adapts fan inlet to roof curb.

##### Same material as fan housing.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Roof Curb:

##### Factory fabricated.

##### [With] [Without] damper tray.

##### Sloped to match roof pitch, and to provide level top.

##### Height Above Finished Roof: [300 mm.] [As scheduled – refer to subsection 3.7 Supplements.]

##### [Galvanized steel] [Aluminum] construction.

##### Mitered, continuous welded corner seams.

##### Pressure-treated wood nailer.

##### Insulation: Minimum 38 mm-thick, 48 kg per cubic metre density, rigid mineral fibreboard insulation with metal liner.

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X].

#### Inlet Vanes: Variable position, for manual or automatic operation.

#### Housing Access Doors: Bolted and gasketed.

#### Shaft Seal: Elastomeric.

#### Inlet Screen: Metal, spiral wire type, OHSA compliant, removable.

#### Inlet Bell: Factory-fabricated aerodynamic bell, bolted to fan inlet, same material as fan housing.

#### Inlet Cone: Factory fabricated, conical fan to duct transition, bolted to housing flange, same material as fan housing.

#### Support Base: Welded metal, for standard platform or floor mounting.

#### Spark Resistant Construction: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

1. Wheel (or propeller).

2. Housing.

3. Accessories.

4. Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Roof Gravity Ventilator, Louvered

### General: Factory-assembled louvered exhaust or gravity relief vent; including housing and accessories, suitable for roof mounting.

### Housing:

#### Construction:

##### Rectangular, tiered extruded aluminum construction, with welded miter cut joints, 12 gauge minimum thickness.

##### Louvered on all four sides.

##### Aluminum support structure, 8 gauge minimum thickness.

#### Base:

##### Reinforced and braced.

##### Integral snow and storm baffle.

##### Minimum panel thickness, 12 gauge.

##### Miter cut continuously welded curb cap corners.

#### Hood:

##### Overhang sufficient to provide weatherproof inlet.

##### Minimum panel thickness, 14 gauge.

##### Anti-condensate insulation coating inside hood.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Gravity Backdraft Damper: Gravity operation, adjustable counterweight, aluminum construction.

#### Motorized Damper: Aluminum frame, aluminum blades, aluminum hinge pins with nylon bushings, [120V] [12V] operator.

#### Bird Screen: Aluminum construction.

#### Roof Curb:

##### Factory fabricated.

##### [With] [Without] damper tray.

##### Sloped to match roof pitch, and to provide level top.

##### Height Above Finished Roof: [300 mm.] [As scheduled – refer to subsection 3.7 Supplements.]

##### [Galvanized steel] [Aluminum] construction.

##### Mitered, continuous welded corner seams.

##### Pressure-treated wood nailer.

##### Insulation: Minimum 38 mm thick, 48 kg per cubic metre density, rigid mineral fibreboard insulation with metal liner.

#### Inlet Screen: Removable 25 mm mesh screen of coated steel construction over exposed inlets.

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Utility Blower, Centrifugal SWSI, Fibreglass

### General:

#### Factory-assembled utility blower; including housing, fan wheel, drive assembly, motor and accessories.

#### Fibreglass Construction: In accordance ASTM D4167-15.

#### Suitable to convey air at temperatures up to 121 degrees Celsius.

#### Fan Performance: ANSI/AMCA 99-16 2408 Class [I] [II] [III] [as scheduled].

#### Airstream Hardware: Type 316 stainless steel.

### Fibreglass Material:

#### Construction: Resin reinforced fibre cloth and mat.

#### Resin:

##### Vinyl ester or other qualified thermosetting resin.

##### Selected by fabricator, subject to approval by Consultant and suitable for intended service with no fillers or thixotropic agents.

##### Premium grade and corrosion resistant.

##### Structural wall resin may be of different chemical resistance, subject to conditions of service and approval by the Consultant.

##### [Flame Spread Index:

###### ASTM E84-16, less than 25; fire retardant additives used only in structural layer.

###### Structural wall resin shall contain a minimum of 3 percent antimony trioxide to achieve required flame spread index.]

##### For outdoor locations, add ultraviolet absorbers to surfacing resin to improve weather resistance.

##### Colour:

###### Use no dyes, pigments, or colorants [except in exterior gel coat].

###### Exterior gel coat shall be [white] [ ].

##### For interior locations, final coat shall be factory-applied intumescent coating to achieve designated results for low smoke development.

#### Reinforcement:

##### Veil: Chemical surfacing mat, [Type C (chemical) glass veil] [Nexus Surface Veil] [carbon veil].

##### Chopped Strand Mat: Type E glass, minimum 4.8 Pa, with silane finish and styrene soluble binder.

##### Continuous Roving for Chopper Gun Spray-Up: Type E glass.

##### Woven Roving: Type E glass, nominal 8.1 Pa, 4 by 5 weave, with silane type finish.

#### Laminate:

##### Inner Surface (Veil):

###### Resin rich, veil reinforced, minimum 10 mils to maximum 20 mils thick.

###### Use no additives.

###### Finish and binder compatible with lay up resin.

###### Reinforcement Content: Maximum of 20 percent.

##### Interior (Corrosion) Layer:

###### Resin rich, a minimum of two plies of chopped strand mat, nominal 100 mils to 120 mils thick.

###### Use no additives.

###### Construct interior layer of resin reinforced with at least two plies of chopped strand mat backing the veil.

###### Reinforcement Content: 25 plus or minus 5 percent.

##### Exterior (Structural) Layer:

###### Resin with mat, cloth, woven roving or chopped strand glass reinforcement.

###### Enough resin present to prevent surface fibre show.

###### Exterior surface relatively smooth, with no exposed fibres or sharp projections.

##### Wall Thickness: As required for equipment structural integrity, but no less than 4.8 mm.

### Housing:

#### Material: Fibreglass.

#### Construction:

##### Curved scroll configuration.

##### Integral flanges to ensure housing concentricity and housing strength.

##### Flanged outlet to permit duct connection.

##### Drain connection located at lowest point of fan housing.

##### Inlet:

###### Die-formed bell mouth of fibreglass construction.

###### Fibreglass supports.

###### Bolted to housing to permit wheel removal.

##### Shaft Seal: Viton construction, located at shaft penetration of housing.

#### Base/Pedestal: All-welded heavy gauge [steel] [Type 316 stainless steel].

### Wheel:

#### Material: Fibreglass.

#### Centrifugal, one-piece, non-overloading, [radial blade type] [backward inclined airfoil blade type] [blade type as scheduled – refer to subsection 3.7 Supplements].

#### Wheel hub permanently bonded to shaft and completely encapsulated in fibreglass.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished Type 304 stainless steel.

##### Ends drilled and tapped for wheel installation.

##### Keyed for sheave installation.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives.*[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Belt.] [Direct.]

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 10.] [Arrangement 9.] [Arrangement 4.] [Arrangement 1.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Housing Access Doors: Bolted and gasketed.

#### Curb Base: Molded one-piece fibreglass, seamless construction.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X] [as scheduled – refer to subsection 3.7 Supplements].

#### Flanged Inlet: Heavy fibreglass construction, factory drilled and flanged.

#### Shaft Seal: Fibreglass and neoprene construction, located at shaft penetration of housing.

#### Belt Guard: OHSA compliant, carbon steel sheet metal, for complete coverage of belts and sheaves.

#### Shaft and Bearing Guard: Carbon steel sheet metal for complete coverage of shaft and bearings.

#### Motor and Drive Cover:

##### Factory fabricated, OHSA compliant.

##### Carbon steel sheet metal construction.

##### Vented, openings sufficient size for proper motor cooling.

#### Inlet Screen: Removable 25 mm mesh screen of coated steel construction over exposed inlets.

#### Unitary Sub-base:

##### Structural metal sub-base, same material as fan housing.

##### Bolted to bottom of fan base/pedestal.

##### Drilled for field installation of vibration isolators.

#### Spark Resistant Construction:

##### Carbon fibre veil impregnated in housing and wheel fibreglass resin corrosion barrier.

##### Static grounding.

##### Classification: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

1. Steel components.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents.]*

##### [Coating system shall be in accordance with Section 09900 – Painting and Protective Coatings.]

## Utility Blower, Centrifugal SWSI, Heavy Duty

### General:

#### Factory-assembled utility blower; including housing, fan wheel, drive assembly, motor, and accessories.

#### Suitable to convey air at temperatures up to 121 degrees Celsius.

#### Fan Performance: ANSI/AMCA 99-16 2408 Class [I] [II] [III] [as scheduled – refer to subsection 3.7 Supplements].

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housing:

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Construction:

##### Curved scroll configuration, with continuous seam welding and side angle reinforcement.

##### Lifting lugs welded to housing.

##### Flanged and drilled outlet to permit duct connection.

##### Drain connection located at lowest point of fan housing.

##### Inlet: Spun-formed aerodynamic bell mouth.

#### Base/Pedestal: All-welded heavy gauge [steel] [Type 316 stainless steel].

### Wheel:

#### Centrifugal, one-piece, non-overloading, [radial blade type] [backward inclined flat blade type] [backward inclined airfoil blade type] [blade type as scheduled – refer to subsection 3.7 Supplements].

#### Material: [Steel.] [Aluminum.] [Type 304 Stainless Steel.] [Type 316 Stainless Steel.]

#### Attached to fan shaft with split taper lock bushing.

### Shaft, Bearings, Drive:

#### Shafts:

##### Turned, ground and polished steel.

##### Ends drilled and countersunk for tachometer readings.

##### Keyed for sheave installation.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning type.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Belt.] [Direct.]

##### Arrangement: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Arrangement 9.] [Arrangement 10.] [Arrangement 4.] [Arrangement 1.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Housing Access Doors: Bolted and gasketed.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X] [as scheduled – refer to subsection 3.7 Supplements].

#### Flanged Inlet: Heavy gauge construction, factory drilled and flanged.

#### Shaft Seal: Viton construction, located at shaft penetration of housing.

#### Belt Guard: OHSA compliant, sheet metal construction same material as fan housing, for complete coverage of belts and sheaves.

#### Shaft and Bearing Guard: Sheet metal construction same material as fan housing, for complete coverage of shaft and bearings.

#### Motor and Drive Cover:

##### Factory fabricated, OSHA type. *[Consultant to determine whether an equivalent Canadian standard exists or be familiar with the US OSHA standards as applicable to this section]*

##### Sheet metal construction, same material as fan housing.

##### Vented, openings sufficient size for proper motor cooling.

#### Inlet Guard: Spiral wire type, OHSA compliant, removable, same material as fan housing.

#### Unitary Sub base:

##### Structural metal sub base, same material as fan housing.

##### Bolted to bottom of fan base/pedestal.

##### Drilled for field installation of vibration isolators.

#### Spark Resistant Construction Classification: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel (or propeller).

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] air-dry epoxy] baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 - Painting and Protective Coatings.]

## Wall Fan, Centrifugal

### General:

#### Factory-assembled centrifugal wall fan; including housing, fan wheel, drive assembly, motor and accessories.

#### Bearing AMCA Certified Ratings Seal for sound and air performance.

### Housing:

#### Construction: Spun-formed aluminum, minimum 16 gauge marine alloy.

#### Windband: Finish with rolled bead.

#### Cap: Motor access via quick release latches.

#### Motor completely sealed from exhaust air stream.

#### Motor cooling via air breather tubes.

#### Integral conduit chase for wiring.

#### Fan Inlet:

##### Full inlet cone of aluminum construction.

##### Match inlet shroud.

#### Wall Flange: Aluminum construction, with pre-punched key slot holes.

### Fan Wheels:

#### Aluminum construction, backward inclined centrifugal, non-overloading type.

#### Machined, cast aluminum hub.

#### Matched to deep spun inlet venturi.

### Shaft, Bearings, Drive:

#### Shaft:

##### Turned, ground and polished carbon steel.

##### Keyed for sheave installation.

##### Zinc-phosphate coated and oil emulsion-dipped.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning, pillow block style.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

##### Terminate with zerk fittings.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Belt.] [Direct.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Gravity Backdraft Damper: Gravity operation, adjustable counterweight, aluminum construction.

#### Motorized Damper: Aluminum frame, aluminum blades, aluminum hinge pins with nylon bushings, [120V] [12V] operator.

#### Bird Screen: Aluminum construction.

#### Disconnect: Factory installed, non-fused, NEMA [3R] [4X] [as scheduled].

#### Bearing Lubrication Lines:

##### Extended to outside of fan housing.

##### Type 316 stainless steel construction.

##### Terminate with zerk fittings.

#### Spark Resistant Construction: Classification: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled – refer to subsection 3.7 Supplements].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Wheel.

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with the Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 - Painting and Protective Coatings]

## Wall Fan, Propeller, Heavy Duty

### General: Factory-assembled wall propeller fan; including housing, propeller, drive assembly, motor and accessories.

### Housing:

#### Panel:

##### Minimum 14 gauge mild steel construction.

##### Integral formed venturi orifice.

##### Continuously welded corners.

##### Bolted to frame.

#### Frame:

##### Minimum 14 gauge steel construction.

##### Continuously welded joints.

##### Reinforced motor base plate.

### Propeller

#### Cast aluminum construction.

#### Hub keyed and mechanically locked to shaft.

### Shaft, Bearings, Drive:

#### Shaft:

##### Turned, ground and polished carbon steel.

##### Keyed for sheave installation.

#### Bearings:

##### Grease lubricated, precision antifriction ball, self-aligning, sealed pillow block style.

##### Mounted in cast iron pillow block housing.

##### Selected for average life (ABMA 9, average life L50) of not less than 200,000 hours operation at maximum cataloged operating speed.

#### Drives:

##### In accordance with Contract Documents pertaining to Drives. *[Consultant to provide details and ensure such details are in the Contract Documents]*

##### Factory set to the specified fan revolutions per minute.

##### Type: [As scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [Belt.] [Direct.]

##### Belts: Oil and heat resistant, non-static type.

### Accessories: Provide [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements.] [as follows:]

#### Disconnect: Factory-installed, non-fused, NEMA [12] [4X] [as scheduled – refer to subsection 3.7 Supplements].

#### Propeller-Side Guard: Galvanized steel construction.

#### Motor-Side Guard: Galvanized steel construction.

#### Weather Hood:

##### Heavy-gauge galvanized steel construction, to match fan and accessory size.

##### Galvanized steel expanded metal bird screen.

#### Wall Housing:

##### Allows fan mounting on interior or exterior wall.

##### Heavy-gauge galvanized steel construction.

#### Shutters, Gravity Operated:

##### Welded [steel] [aluminum] frame.

##### Extruded aluminum blades.

##### Felt edge seals.

##### Oil impregnated bronze bushings.

##### Reverse flange for building exterior mounting. Standard flange for indoor mounting.

#### Shutters, Motor Operated:

##### Welded [steel] [aluminum] frame.

##### Extruded aluminum blades.

##### Stainless steel edge seals.

##### Oil impregnated bronze bushings.

##### 120 volt spring return damper actuator with end switch.

##### Reverse flange for building exterior mounting. Standard flange for indoor mounting.

#### Spark Resistant Construction:

##### Non-ferrous blade assembly.

##### Classification: ANSI/AMCA 99-16 0401 Type [A] [B] [C] [as scheduled].

#### Corrosion Protection Coating:

##### Provide factory-applied corrosion protection coating on these fan components:

###### Housing.

###### Accessories.

###### Interior surfaces in contact with airstream.

##### [Coating system shall be [baked enamel] [baked polyester] [air-dry epoxy] [baked epoxy] [air dry phenolic] [baked phenolic] [baked epoxy phenolic] [as scheduled in the Equipment Schedule – refer to subsection 3.7 Supplements], and shall be in accordance with Contract Documents pertaining to Corrosion Protection Coating.] *[Consultant to ensure such details are in the Contract Documents]*

##### [Coating system shall be in accordance with Section 09900 - Painting and Protective Coatings.]

## Corrosion Protection Coating

### General:

#### Factory-applied corrosion protection coating for application to fan components and accessories, where required by this Section.

#### Quality Control:

##### Verify dry film thickness before final baking.

##### Finished coating system shall be free from voids, checks, cracks and blisters.

#### Surface Cleaning: Clean parts to be coated as follows:

##### Immerse parts in heated cleaning solution to remove lubricants, machining oils, and residual factory contamination.

##### Follow with immersion in potable water bath to neutralize and remove cleaning solution.

##### Chemical Pre-treatment: Immerse parts in heated chemical solution, iron phosphate for steel, clear/yellow chromate for aluminum.

### Baked Enamel:

#### Material: Alkyd modified urea-melamine single component baking enamel.

#### Surface Preparation: Clean surface in accordance with SSPC-SP 3.

#### Application: Standard air-pressurized spray equipment.

#### Curing: Oven baked at a metal temperature not to exceed 149˚C.

#### Finished Thickness: 1 mil to 2 mil dry film thickness.

#### Performance: Coating shall meet or exceed the following criteria:

##### Impact Resistance: 0.115 kg metre, ASTM D2794-93 (2010) test method.

##### Pencil Hardness: 2H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 110˚C, continuous.

### Baked Polyester:

#### Material: Polyester.

#### Surface Preparation: Sandblast surface in accordance with SSPC-SP 5/NACE No. 1.

#### Application: Electrostatic spray.

#### Curing: Oven baked at a metal temperature not to exceed 204˚C.

#### Finished Thickness: 1.5 mil to 2.5 mil dry film thickness.

#### Performance: Coating shall meet or exceed following criteria:

##### Salt Spray Test: Minimum 1,000 hour duration, ASTM B117-16 test method.

##### Humidity Resistance: Minimum 1,000 hour duration, ASTM D2247-15 test method.

##### Impact Resistance: 1.15 kg metre, ASTM D2794-93 (2010) test method.

##### Pencil Hardness: 2H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 110˚C, continuous.

### Air-Dry Epoxy:

#### Material: Two-part catalyzed epoxy.

#### Surface Preparation: Clean surface in accordance with SSPC-SP 3.

#### Application: Standard air-pressurized spray equipment.

#### Curing: Air dry.

#### Finished Thickness: 4 mil to 6 mil dry film thickness.

#### Performance: Coating shall meet or exceed following criteria:

##### Salt Spray Test: Minimum 1,500 hour duration, ASTM B117-16 test method.

##### Pencil Hardness: H-2H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 65˚C, continuous.

### Baked Epoxy:

#### Material: Epoxy.

#### Surface Preparation: Sandblast surface in accordance with SSPC-SP 10/NACE No.2.

#### Application: Electrostatic spray.

#### Curing: Oven baked at a metal temperature not to exceed 204˚C.

#### Finished Thickness: 2.5 mil to 3.5 mil dry film thickness.

#### Performance: Coating shall meet or exceed following criteria:

##### Salt Spray Test: Minimum 1,000 hour duration, ASTM B117-16 test method.

##### Humidity Resistance: Minimum 1,000 hour duration, ASTM D2247-15 test method.

##### Impact Resistance: 1.15 kg metre, ASTM D2794-93 (2010) test method.

##### Pencil Hardness: 2H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 110˚C, continuous.

### Air Dry Phenolic:

#### Material: Phenolic resin. For outdoor applications, apply an UV resistant topcoat

#### Surface Preparation: Sandblast surface in accordance with SSPC-SP 6/NACE No. 3.

#### Application: Standard air-pressurized spray equipment.

#### Curing: Air dry.

#### Finished Thickness: 4 mil to 6 mil dry film thickness.

#### Performance: Coating shall meet or exceed following criteria:

##### Salt Spray Test: Minimum 500 hour duration, ASTM B117-16 test method.

##### Humidity Resistance: Minimum 500 hour duration, ASTM D2247-15 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 82˚C continuous

##### Minimum Adhesive Strength: [7 MPa]

### Baked Phenolic:

#### Material: Phenolic resin

#### Surface Preparation: Sandblast surface to SSPC-SP 5/NACE No. 1.

#### Application: Standard air-pressurized spray equipment.

#### Curing: Oven baked at a metal temperature not to exceed 204˚C.

#### Finished Thickness: 5 mil to 7 mil dry film thickness.

#### Performance: Coating shall meet or exceed the following criteria:

##### Salt Spray Test: Minimum 1,000 hour duration, ASTM B117-15 test method.

##### Humidity Resistance: Minimum 1,000 hour duration, ASTM D2247-15 test method.

##### Impact Resistance: 1.15 kg metre, ASTM D2794-93 (2010) test method.

##### Pencil Hardness: 2H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

##### Service Temperature: Maximum 121˚C, continuous

##### Flexibility: passes [1 inch] on a Mandrel Bend Test

##### Abrasion Resistance: maximum weight loss of [80mg] per 1,000 cycles cs-17 wheel with 1kg weight.

### Baked Epoxy Phenolic:

#### Material:

##### Baking cross-linked epoxy-phenolic.

##### For outdoor applications, apply an UV resistant topcoat.

#### Surface Preparation: Sandblast surface in accordance with SSPC-SP 5/NACE No. 1.

#### Application: Electrostatic or conventional compressed air spray equipment.

#### Curing: Oven baked at a metal temperature not to exceed 204˚C.

#### Finished Thickness: 6 mil to 8 mil dry film thickness.

#### Performance: Coating shall meet or exceed following criteria:

##### Salt Spray Test: Minimum 1,000 hour duration, ASTM B117-16 test method.

##### Humidity Resistance: Minimum 1,000 hour duration, ASTM D2247-15 test method.

##### Impact Resistance: 1.84 kg metre, ASTM D2794-93 (2010) test method.

##### Pencil Hardness: 3H, ASTM D3363 (2011)e2 test method.

##### UV Resistance: UV inhibited life of minimum 10 years when exposed to sun in the Province of Ontario.

#### Service Temperature: Maximum 177 degrees Celsius, continuous.

## Motors

### General:

#### Fan motors shall comply with the provisions of Section 16222 – Motors: 1 to 200 kW, 575 V.

#### Provide integral self-resetting overload protection on single-phase motors.

#### Motors for fans specified for use with variable frequency drives shall be inverter duty type. The Contractor must be familiar with the facility power quality so any electrical components (including VFD’s) can fully function under typical levels of power quality as delivered by the Local Distribution Company (LDC). The Contractor shall provide electrical devices to protect electrical components (including VFD’s) from sags and swells experienced from LDC at no additional cost to the Region.

#### Motors shall not operate into service factor in any case.

### Motor requirements shall be as follows, unless designated otherwise on the Equipment Schedule – refer to subsection 3.7 Supplements [on the Drawings]:

#### Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.

#### Winding Thermal Protection: None.

#### Space Heater: None

#### Number of Speeds: Single.

#### Number of Windings: One.

#### Motor Efficiency: [Energy efficient.] [Premium efficient.]

#### Shaft Type: Solid, carbon steel.

#### Mounting: As required for fan arrangement.

#### Service Factor: 1.15.

## Accessories

### Equipment Identification Plates: Furnish a16 gauge [Type ]stainless steel identification plate securely mounted on each separate equipment component [and control panel] in a readily visible location. The Plate shall bear [10] [6] mm high [engraved] [die-stamped]block type [black enamel filled] equipment [identification number] [and letters] indicated in this Section [and as shown on the Drawings].

### Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 45 kg.

## Source Quality Control

### General:

#### Fan shall operate at single stable point as indicated by the fan curve provided by the Equipment manufacturer. Fans having two potential operating points are not acceptable.

#### Fan and motor combination shall be capable of delivering 110 percent of scheduled air quantity and static pressure. Motor shall not operate into motor service factor in any listed case.

#### Consider drive efficiency in motor selection according to the manufacturer’s published recommendations or according to ANSI/AMCA 203-90 (R2011), Appendix L. *[Consultant to confirm reference]*

### Testing Provisions:

#### Provide tachometer access holes large enough to accept standard tachometer drive shaft.

#### Center punch fan shaft to accommodate tachometer readings.

### Acoustical Levels:

#### Perform noise tests in accordance with ANSI/AMCA 300-14 and ANSI/AMCA 301-14.

#### Fan sound power levels (dB, Reference 10-12 Watts) shall be no greater than scheduled values.

### Balancing:

#### Unless noted otherwise, each fan wheel shall be statically and dynamically balanced to ANSI/ASA S2.19-1999 (R2004) Grade G6.3.*[Consultant to confirm reference]*

#### Fans controlled by variable frequency drives shall be dynamically balanced at speeds 25 percent, 50 percent, 75 percent, and 100 percent of design revolutions per minute.

### Vibration Test:

#### Each fan furnished with a 3.7 kW or larger motor shall have factory run vibration test, including vibration signatures taken on each bearing in horizontal, vertical, and axial directions.

#### Vibration reading as measured at scheduled rotational speed shall not exceed the following values when fan is rigidly mounted:

##### Belt Drive (except Vane Axial): 0.38 cm per second peak velocity.

##### Belt Drive Vane Axial: 0.2 cm per second peak velocity.

##### Direct Drive: 0.2 cm per second peak velocity.

#### Written records of run tests and vibration tests shall be made available to the Consultant upon request.

# EXECUTION

## Installation

### Install fans level and plumb.

### Secure roof-mounted fans to roof curbs with [cadmium-plated steel] [Type 316 stainless steel] hardware.

### Ceiling Units: Suspend units from structure; use steel wire or metal straps.

### Scroll Drains: Pipe drain connection through running trap to floor drain.

### Labeling:

#### Label fans in accordance with the Contract Drawings.

#### Mark exhaust fans serving fume hoods with arrows to indicate proper direction of rotation, in accordance with NFPA 45, 2015 Edition.

### Service Access: Locate units to provide access spaces required for motor, drive, bearing servicing, and fan shaft removal.

### Equipment Support and Restraints:

#### Refer to Section [      ] - Vibration Isolation and Seismic Restraints.

#### Install floor-mounted units on concrete bases [designed to withstand, without damage to equipment, the seismic force required by code]**.**

#### Secure vibration [and seismic] controls to concrete bases using anchor bolts cast in concrete base.

#### Seismic Restraint Snubbers: Install with sufficient clearance so unit isolators are not restricted for proper free isolation, but do limit movement in all directions.

### Connections

#### Refer to Section 15810 - Metal Ductwork and Accessories for additional requirements.

#### Isolate duct connections to fans.

#### Install ductwork adjacent to fans to allow for proper service and maintenance.

## Field Quality Control

### Functional Tests:

#### Verify that all blocking and bracing used during shipping are removed.

#### Verify that the fan is secure on mountings and supporting devices, and connections to ducts and electrical components are complete.

#### Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

#### 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.

#### Verify lubrication for bearings and other moving parts.

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

### Performance Tests:

#### Starting Procedures:

##### Energize motor and adjust fan to the indicated revolutions per minute.

##### Measure and record motor voltage and amperage.

#### Operational Test:

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

##### Repair or replace malfunctioning units; retest as specified after repairs are complete or after replacements have been made.

##### Test and adjust control safeties.

##### Replace damaged and/or malfunctioning controls and equipment.

## Manufacturer’s Services

### Provide the services of a manufacturer’s representative at the Site in accordance with Section 01640 - Manufacturers’ Services, for installation assistance, inspection and certification of proper installation, equipment testing, startup assistance, and training of the Region’s personnel for each specified component, sub-system, equipment, or system.

### Manufacturer’s Representative: Present at Site or classroom designated byRegion, for minimum person-days listed below, travel time excluded:

#### [ ] Person-Days for [installation assistance] [and] [inspection.]

#### [ ] Person-Days for [functional] [and] [performance]testing and completion of Manufacturer’s Certificate of Proper Installation.

#### [ ] Person-Days for pre startup classroom or site training.

#### [ ] Person-Days for facility startup.

#### [ ] person-days for post-startup training [of Region’s personnel.]

#### Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by the Consultant and approved by the Region.

### Refer Section 01640 - Manufacturers’ Services and Section 01810 - Equipment Testing and Facility Commissioning.

## Adjusting

### Adjust damper linkages for proper damper operation.

### Adjust belt tension.

### Lubricate bearings.

### Balancing:

#### Perform air system balancing as specified in Section 15950 - HVAC Systems Testing, Adjusting, and Balancing.

#### Replace fan and motor sheaves as required to achieve design airflow.

### Vibration Testing:

#### Perform field testing on rotating equipment, where specified in Section 15950 - HVAC Systems Testing, Adjusting, and Balancing, to determine actual operating vibration.

#### If vibration limits described therein are exceeded, rebalance equipment in-place until design tolerances are met.

## Cleaning

### After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

### On completion of installation, internally clean fans according to manufacturers’ written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

## Commissioning

### For all commissioning activities on systems where components of this Specification are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning. All inspection and testing activities shall be completed with documentation provided to the Consultant prior to start of commissioning such activities.

### When a Building Automation System (BAS) is part of the Work, the Contractor shall ensure all aspects of commissioning be integrated with the commissioning of the BAS. *[Consultant to provide additional requirements as needed]*

## Supplements

### The supplements listed below, attached following “End of Section,” form a part of this Section:

#### 15830-01, Fan Schedule.

#### 15830-02, Ceiling Fan Schedule.

**END OF SECTION**