METROLINX

Capital Projects Group

HVAC Fans Specification

Specification 23 34 00

Revision 1
Date: September 2018

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Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
Various	Sept. 20, 2018	Revised to coordinate with corresponding specifications.

LIST OF CONTENT

1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Provide HVAC fans equipment as required, scheduled and specified herein.

1.2. DESIGN REQUIREMENTS

1.2.1. Design requirements are based on Part 2 specified requirements of products.

1.3. RELATED WORKS

1.3.1. Section 20 05 05 - Mechanical Work General Instructions.

1.3.2. Section 20 05 10 - Basic Mechanical Materials and Methods.

1.3.3. Section 20 05 40 – Mechanical Work Commissioning.

1.4. REFERENCE STANDARDS

1.4.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.

1.4.2. AMCA 99 Standards Handbook.

1.4.3. AMCA 99-2408 Operating Limits for Centrifugal Fans.

1.4.4. ANSI/AMCA Standard 204 Balance Quality and Vibration Levels for Fans.

1.4.5. ANSI/AMCA Standard 205 Energy Efficiency Classification for Fans.

1.4.6. ANSI/AMCA Standard 210 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

1.4.7. AMCA Publication 211 Certified Ratings Programme - Product Rating Manual for Fan Air Performance.

1.4.8. AMCA Publication 311 Certified Ratings Programme - Product Rating Manual for Fan Sound Performance.

1.4.9. AMBA - Method of Evaluating Load Ratings of Bearings ANSI-11.

1.4.10. OSHA guideline 1910.212 General requirements for Machine Guarding.

1.4.11. OSHA guideline 1910.219 General requirements for guarding safe use of mechanical power transmission apparatus. (www.osha.gov)

1.4.12. UL Standard 705 Power Ventilators.

1.5. TRAINING

1.5.1. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

1.5.2. Include for 3 training sessions of maximum 7 hours duration per session for 7 Metrolinx people per session.

1.5.3. Refer to Section 20 05 05 for additional general requirements.

1.6. WARRANTY

1.6.1. Products to be guaranteed by manufacturer, for a minimum of 2 years after acceptance by Metrolinx.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Handle and store products in accordance with manufacturer's instructions, in locations approved by Metrolinx. Include one copy of these instructions with product at time of shipment.

1.8. SUBMITTALS

1.8.1. Refer to submittal requirements in Section 20 05 05.

1.8.2. Submit shop drawings/product data sheets as follows:

a) to regulatory authority for review and approval prior to submitting to Consultant;

b) for all products specified in this Section except pipe and fittings;

c) copies of all calculations stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing requirements.

1.8.3. Product Data

a) Submit product data sheets indicating:

1) technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;

2) performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol;

3) product transportation, storage, handling, and installation requirements;

4) product identification in accordance with Metrolinx requirements.

1.8.4. Shop Drawings

a) Submit shop drawings indicating:

1) capacity and ratings;

2) mounting details to suit locations shown, indicating methods and hardware to be used;

3) control components and control wiring schematic.

1.8.5. Commissioning Package

a) Submit the following in accordance with Sections 20 05 05 and 20 05 40:

1) Commissioning Plan;

2) Commissioning Procedures;

3) Certificate of Readiness;

4) complete test sheets specified in Section 20 05 40 and attach them to the Certificate of Readiness;

5) Source Quality Control inspection and test results and attach to the Certificate of Readiness.

1.8.6. Commissioning Closeout Package

a) Submit the following in accordance with Section 20 05 05:

1) Deficiency Report;

2) Commissioning Closeout Report;

3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals in accordance with Section 20 05 05:

i) Identification: manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems;

ii) functional description detailing operation and control of components;

iii) performance criteria and maintenance data;

iv) safety precautions;

v) operating instructions and precautions;

vi) component parts availability, including names and addresses of spare part suppliers;

vii) maintenance and troubleshooting guidelines/protocol;

viii) product storage, preparation, handling, and installation requirements;

ix) Commissioning Report.

1.9. QUALITY ASSURANCE

1.9.1. Site personnel are to be licensed in jurisdiction of the work and under continuous supervision of a foreman who is an experienced HVAC system installer.

1.9.2. Manufacturers Qualifications

a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced similar product for a minimum period of five years. When requested by Consultant, an acceptable list of installations with similar product shall be provided demonstrating compliance with this requirement.

b) Where manufacturers provide after installation onsite inspection of product installations, include for manufacturer's authorized representative to perform onsite inspection and certificate of approvals.

1.9.3. Installers Qualifications

a) Installers for work to be performed by or work under licensed Mechanical Contractor.

b) Installers of equipment, systems and associated work are to be fully qualified and experienced installers of respective products and work in which they are installing.

c) Where manufacturers provide training sessions to installers and certificates upon successful completion, installers to have obtained such certificates and submit copies with shop drawings.

1.9.4. Regulatory Requirements

a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.

b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. ROOF CENTRIFUGAL EXHAUST FANS

2.1.1. Roof exhaust fans shall be centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure.

2.1.2. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.

2.1.3. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing.

2.1.4. NEMA 4 disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

2.1.5. Fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

2.1.6. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

2.1.7. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.2. ROOF UPBLAST EXHAUST FANS

2.2.1. Roof exhaust fans shall be upblast centrifugal belt driven type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. Windbands shall have a rolled bead for added strength and shall be joined to curbcaps with a leakproof, continuously welded seam.

2.2.2. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.

2.2.3. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

2.2.4. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

2.3. SIDEWALL CENTRIFUGAL EXHAUST FANS

2.3.1. Sidewall exhaust fans shall be of the centrifugal belt driven type.

2.3.2. Construction of the windband shall be of heavy gauge aluminum with a rolled bead on the outer edge for strength. The fan wheel and inlet cone shall be aluminum and of the high performance centrifugal blower type. The fan wheel shall be of the aluminum, non- overloading, backward inclined type, statically and dynamically balanced. Blades, fins, inlet cones and back plates shall be securely fastened together into a rigid assembly.

2.3.3. Motors and drives shall be isolated from the exhaust airstream. Motors shall be of heavy duty type with permanently lubricated, sealed ball bearings. Air for cooling the motor shall be taken into the motor compartment by means of an air tube from a location free of discharge contaminants. The entire drive assembly and wheel, as a unit, shall be removable through the support structure without dismantling the fan housing. The wheel shaft shall be mounted in heavy duty, permanently lubricated, sealed ball bearing pillow blocks. Drives shall be sized for 165% of driven horsepower. Pulleys shall be of the machined cast iron type, keyed securely to the fan and motor shafts. Motor pulleys shall be of the adjustable type to allow for final system balancing. The entire drive assembly shall be mounted on vibration isolators to minimize noise transmission.

2.3.4. Fans shall be AMCA licensed for air and sound performance data.

2.4. SIDEWALL AXIAL EXHAUST FANS

2.4.1. Belt driven, axial type sidewall fans shall be as describe herein.

2.4.2. Propellers shall be constructed with cast aluminum blades and hubs. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced.

2.4.3. Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure.

2.4.4. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to wheel and motor shafts. Motors sheaves shall be adjustable for system balancing.

2.4.5. Drive frame and panel assemblies shall be galvanized steel or painted steel. Drive frames shall be formed channels and fan panels shall have pre-punched mounting holes, formed flanges, and a deep formed inlet venturi. Drive frames and panels shall be bolted construction or welded construction.

2.4.6. The axial exhaust fans shall bear the AMCA Certified Ratings Seals for both sound and air performance.

2.5. IN-LINE CENTRIFUGAL FANS

2.5.1. Duct mounted supply, exhaust or return fans shall be of centrifugal belt driven in-line type. The fan housing shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars.

2.5.2. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.

2.5.3. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

2.5.4. Motors shall be heavy duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the airstream.

2.5.5. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed.

2.5.6. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

2.5.7. Motor pulleys shall be adjustable for system balancing. A NEMA 1 disconnect switch shall be provided as standard, except with explosion resistant motors, where disconnects are optional. Factory wiring shall be provided from motor to the handy box.

2.5.8. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

2.5.9. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.6. SINGLE WIDTH, SINGLE INLET UTILITY TYPE FANS

2.6.1. Fan Housing and Outlet

a) Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.

b) The housings on all fan sizes shall be of continuously welded heavy gauge steel. All interior and exterior surface steel shall be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be gray. No uncoated metal fan parts will be allowed.

c) Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.

d) OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).

2.6.2. Fan Wheel

a) The fan wheel shall be of the non-overloading single width airfoil centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.

b) Fan wheel shall be manufactured with continuously welded steel airfoils and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be industrial gray.

c) The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

2.6.3. Fan Motors and Drive

a) Motors to be NEMA T-frame, 1800 or 3600 RPM, Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor.

b) Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.

c) Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.

d) Fan shaft bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.

e) Bearings shall have equal to Zerk fittings to allow for lubrication.

2.7. DOUBLE WIDTH, DOUBLE INLET FANS

2.7.1. Fan Housing and Outlet

a) Fan housing shall be doublewide to accommodate the backward inclined double width wheel.

b) Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.

c) The housings on all fan sizes shall be of continuously welded heavy gauge steel. All interior and exterior surface steel shall be coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be gray. No uncoated metal fan parts will be allowed.

d) Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.

e) OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).

2.7.2. Fan Wheel

a) The fan wheel shall be of the non-overloading Double Width Backward Inclined centrifugal type. Wheels shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19.

b) Fan wheel shall be manufactured with continuously welded steel blades and coated with a minimum of 2-4 mils of Permatector (Polyester Urethane), electrostatically applied and baked. Finish color shall be industrial gray.

c) The wheel and fan inlet shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

2.7.3. Fan Motors and Drive

a) Motors to be NEMA T-frame, 1800 or 3600 RPM, Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) with a 1.15 service factor.

b) Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower, and shall be readily and easily accessible for service, if required.

c) Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.

d) Fan shaft bearings shall be Air Handling Quality, bearings shall be heavy-duty grease lubricated, self-aligning or roller pillow block type. Bearings shall be 100% tested for noise and vibration by the manufacturer. Bearings shall be 100% tested to insure the inner race diameter is within tolerance to prevent vibration. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours at maximum operating speed. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.

e) Bearings shall have Zerk or approved equivalent fittings to allow for lubrication.

2.7.4. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.8. CORROSION RESISTANT CENTRIFUGAL FANS

2.8.1. Centrifugal FRP fans in accordance with drawing schedule, with drive arrangement and configuration as indicated on drawings, and capable of operating over complete pressure class limits as specified in AMCA Standard 99-2408.

2.8.2. Aerodynamically designed housing with high efficiency inlet, manufactured from resins, UV inhibited, reinforced with fibreglass, and with bolts holding housing to support plate encapsulated in FRP, and no uncoated metal in contact with corrosive air stream. Each assembly is to be complete with graphite impregnated interior casing, lifting lugs, type 304 stainless steel fasteners, a FRP ridge inside casing to divert condensation from dripping over hub and shaft, a flanged inlet and outlet, and an impeller inspection and service access door.

2.8.3. Backward curved FRP wheel electronically statically and dynamically balanced after assembly, with an integral metal back plate encapsulated in resin and with hub extended to outside housing, a removable FRP cap to cover impeller end of shaft, and a vacuum hub seal to prevent contaminated air from escaping from fan housing.

2.8.4. For belt driven fans, type 316 stainless steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and complete with guard, and heavy-duty, sealed, grease lubricated, ball or roller, self-aligning pillow block type bearings selected for an AFBMA L-10 minimum average bearing life in excess of 200,000 hours, and equipped with extended copper lubrication lines terminated in lubrication fittings at exterior of fan assembly, and an adjustable V-belt drive selected for 50% service factor based on motor nameplate data, with FRP OHSA guard in accordance with requirements of Section entitled Basic Mechanical Materials and Methods.

2.8.5. NEMA Premium TEFC motor conforming to requirements of Section 20 05 10.

2.8.6. Rigid, welded structural steel unitary fan and motor support base, factory cleaned and finished with 4 to 6 mm thick baked powder epoxy enamel.

2.8.7. Factory secured seismic restraint connection hardware, as required to comply with local governing codes.

2.8.8. Standard of quality assurance manufacturers are:

a) M. K. Plastics Corp.;

b) New York Blower Co.;

c) Pasticair Inc;

d) or approved equivalent.

2.9. KITCHEN RANGE HOOD EXHAUST FANS

2.9.1. For standard general applications: Reversomatic Htg. & Manufacturing Ltd., Series 3000 “Deluxe” or approved equivalent, stainless steel, ducted range hoods, each per drawing schedule or notes, CSA certified, rotary solid state speed control providing infinite range, rotary light control switch, backdraft damper, with light lens and permanent, washable aluminium mesh grease filters.

2.9.2. Standard of quality assurance manufacturers are:

a) Reversomatic Htg. & Manufacturing Ltd;

b) Zonex;

c) Broan;

d) or approved equivalent.

3. EXECUTION

3.1. INSTALLATION

3.1.1. Provide required fans and install in accordance with manufacturer's instructions to respective installation requirements.

3.1.2. Secure each base mounted fan in place, level and plumb, on vibration isolation on a concrete housekeeping pad.

3.1.3. Secure suspended units in place from structure, level, and plumb, by means of vibration isolation spring hangers, properly sized galvanized steel hanger rods and galvanized structural steel angle or channel trapeze supports.

3.1.4. Rigidly secure each wall mounted fan and accessories in place to structure with hardware, in accordance with fan manufacturer's instructions.

3.1.5. Install explosion-proof units in accordance with classification requirements.

3.1.6. Where required, brace and secure each unit in accordance with local governing code requirements for seismic control and restraint.

3.1.7. Ensure duct connections are made using flexible connection material, where required to isolate vibration.

3.1.8. Confirm kitchen exhaust hood finishes with Metrolinx prior to ordering.

3.1.9. Refer to Section 20 05 10 for equipment/system manufacturer certification requirements.

3.1.10. Refer to Section 20 05 10 for equipment/system start-up requirements.

END OF SECTION