1.1. REFERENCE STANDARDS

1.1.1. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only, latest revision applicable.

1.1.1.1. AMCA 99, "Standards Handbook"

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

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

1.1.1.4. AMCA Publication 211, "Certified Ratings Programme - Product Rating Manual for Fan Air Performance"

1.1.1.5. AMCA Publication 311 "Certified Ratings Programme - Product Rating Manual For Fan Sound Performance"

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

1.1.1.7. OSHA guideline 1910.212 - General requirements for Machine Guarding.

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

1.1.1.9. UL Standard 705, "Power Ventilators"

1.2. ROOF CENTRIFUGAL EXHAUST FANS

1.2.1. 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.

1.2.2. 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.

1.2.3. 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.

1.2.4. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.

1.2.5. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.

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

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

1.3. ROOF UPBLAST EXHAUST FANS

1.3.1. 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.

1.3.2. 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.

1.3.3. 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.

1.3.4. 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.

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

1.4. SIDEWALL CENTRIFUGAL EXHAUST FANS

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

1.4.2. 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.

1.4.3. 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.

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

1.5. SIDEWALL AXIAL EXHAUST FANS

1.5.1. Belt driven, axial type sidewall fans shall provide as follows:

1.5.2. 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.

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

1.5.4. 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.

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

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

1.6. IN-LINE CENTRIFUGAL FANS

1.6.1. 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.

1.6.2. 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.

1.6.3. 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.

1.6.4. 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.

1.6.5. 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.

1.6.6. 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.

1.6.7. 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.

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

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

1.7. SINGLE WIDTH, SINGLE INLET UTILITY TYPE FANS

1.7.1. Fan Housing And Outlet

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

1.7.1.2. 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.

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

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

1.7.2. Fan Wheel

1.7.2.1. 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.

1.7.2.2. 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.

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

1.7.3. Fan Motors And Drive.

1.7.3.1. 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.

1.7.3.2. 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.

1.7.3.3. 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.

1.7.3.4. 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.

1.7.3.5. Bearings shall have Zerk fittings to allow for lubrication.

1.8. <u>DOUBLE WIDTH, DOUBLE INLET FANS</u>

1.8.1. Fan Housing And Outlet

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

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

1.8.1.3. 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.

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

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

1.8.2. Fan Wheel

1.8.2.1. 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.

1.8.2.2. 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.

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

1.8.3. Fan Motors And Drive.

1.8.3.1. 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.

1.8.3.2. 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.

1.8.3.3. 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.

1.8.3.4. 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.

1.8.3.5. Bearings shall have Zerk fittings to allow for lubrication.