

DESIGN REQUIREMENTS

HVAC FANS

GENERAL INFORMATION

- 1.1 This section applies to centrifugal and axial fans.

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- 2.1 The Consultant shall include such considerations as duct leakage (expect 5 percent), temperature heat gain in supply ducts (expect at least 1°F.), resistance through dirty filters, and effect on inlet vanes when sizing the fans. Also consider providing additional capacity. VAV systems shall be furnished with variable speed drives, not variable inlet vanes.
- 2.2 Fan wheel shall have backward inclined blades or air foil type fan blades of the non-overloading type. When laying out fans, the Consultant shall take into consideration duct inlet and outlet conditions to minimize fan effect.
- 2.3 Adequate space and access shall be provided for all fan locations for maintenance and operations.
- 2.4 In order to insure stable operation and prevent any possibility of hunting, the fan curve shall be continuously rising from maximum capacity up to the shut-off pressure. Shut-off pressure minimum shall be 10 percent greater than the design pressure.
- 2.5 Fans shall be selected to operate at or near their point of peak efficiency, thus allowing for operation at capacities of approximately 15% beyond design capacity.
- 2.6 Each fan shall be driven by a constant or variable speed motor. Maximum brake horsepower at design speed shall, under no condition, exceed the nominal motor horsepower. Each fan motor shall be factory mounted. Motors shall be premium efficiency type. Select appropriate motor enclosure for the intended service.
- 2.7 Fans and shafts shall be statically and dynamically balanced at the factory and so certified and be designed for continuous operation at the maximum rated fan speed and motor horsepower.
- 2.8 Provide bearings with service life in excess of 200,000 hours at maximum cataloged fan operating conditions.

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- 2.9 Select fans exposed to corrosive atmospheres constructed of corrosion-resistant materials suitable for intended use, and factory finished with epoxy or other approved corrosion-resistant coatings.
- 2.10 Select fans exposed to elevated temperatures constructed of components rated for high temperature service. Do not use belt drive assemblies exposed to the airstream. Use direct drive motors certified for high temperature service.
- 2.11 Select fans used to convey flammable vapors constructed of non-sparking (non-ferrous) materials, and use explosion-proof motors.
- 2.12 Select fans used to exhaust grease-laden vapors with motor drive and bearings completely external of air stream.
- 2.13 Equipment Requirements
 - a. Belted Utility Vent Sets For Laboratory Exhaust
 - 1. Fume hood exhaust fans shall be belted vent sets. Substitutes will not be accepted. Fans shall be of the centrifugal type with non-overloading, backward-inclined blades. They shall have self-aligning ball bearings with serviceable grease boxes. Fans and motors shall be provided with variable pitch, V-belt pulleys, V-belts, motor angle iron base rails, vibration isolators and welded sheet steel protective hood over the belt and motor assembly. Motor to be explosion-proof, bearing (L50) life of 200,000 hours.
 - 2. Minimum $\frac{3}{4}$ " shaft.
 - 3. The fan scroll housing and fan wheel shall be coated with a corrosion inhibitor similar to a Heresite V504 coating of not less than 5 mils, achieved in a two-coat application.
 - 4. Each fan shall have an electric motor with fan and motor mounted on common base; V-belt drive shall be capable of handling 150% of motor rating, and shall have provision for belt-tension adjustment and shall have at least two V-belts. Sheaves shall be cast iron variable pitch type permitting 10% increase and 10% decrease in design RPM as desired. V-belt drive and pulleys shall have a sheet metal belt guard with $1\frac{1}{2}$ inch diameter holes opposite each motor and fan wheel axle for insertion of a tachometer.
 - 5. Provide scroll access doors, belted shaft guards, spark-resistant construction (AMCA Type C) and aluminum and neoprene shaft sea.
 - b. Axial Fans
 - 1. Airfoil Impeller Blades: Adjustable die cast aluminum alloy or welded steel die formed blades with belt drive. The number of blades shall suit the operation required to prevent fan stalling at low flow.

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2. Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft; to facilitate indexing of blade angle with manual adjustment stops.
 3. Continuously welded casing, with inlet and outlet flange connections, and motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than 1.5 inch wg (375 Pa).
 4. Finish with one coat enamel applied to interior and exterior.
 5. Bearings: Pillow block type, self-aligning, grease-lubricated roller bearings.
 6. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
 7. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed.
 8. Belt Guard: Fabricate to SMACNA Standards; 0.106 inch (2.6 mm) thick, 3/4 inch (19 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 9. Lubrication: Extend lubrication fittings to outside of casing.
 10. Inlet Bell: Bell mouth inlet fabricated of steel with flange.
 11. Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5, with center pod as recommended by manufacturer.
 12. Inlet Screens: Galvanized steel welded grid to fit inlet bell.
- c. Centrifugal Fans
1. Airfoil Wheel: Steel construction with smooth curved inlet flange, back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast steel hub riveted to back plate and keyed to shaft with set screws.
 2. Wheels shall be continuously welded construction.
 3. Steel continuously welded, braced and designed to minimize turbulence with spun inlet bell and shaped cut-off.
 4. Bolted construction with horizontal flanged split housing, where indicated.
 5. Bearings: Pillow block type, self-aligning, grease-lubricated roller bearings.

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6. Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.
 7. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed.
 8. Belt Guard: Fabricate to SMACNA Standard; 0.106 inch (2.6 mm) thick, 3/4 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
 9. Scroll Drain: 1/2 inch (13 mm) steel pipe coupling welded to low point of fan scroll.
- 2.14 The maximum allowable fan vibration shall be .15 in/sec peak velocity, filter-in reading as measured at the fan design RPM.
- 2.15 All fans shall be UL listed.
- 2.16 Fan performance rating shall conform to AMCA 210.
- 2.17 Fans shall bear the AMCA seal for sound and air performance.

CONSTRUCTION REQUIREMENTS

- 3.1 Motors and fan wheel pulleys shall be adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
- 3.2 Provide steel belt guards for motors mounted on the outside of the fan cabinet.
- 3.3 Fans requiring grease shall be installed such that the grease fittings are easily accessible. Install copper extension lubrication lines if required.
- 3.4 Provide sufficient clearances around fans for access and servicing of components. Install fans such that access doors, motors, belts, lubrication lines, electrical connections, etc. are readily accessible and not obstructed by other installations or structures.
- 3.5 Bump start fans to check that fan wheel/impeller rotation corresponds to the desired direction of air flow. Correct fans found to be rotating in a direction opposite to that desired.
- 3.6 Provide two (2) sets of belts for each fan.



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REFERENCE

- 4.1 The applicable CSI Specification Section is 23 34 00.