

INSPECTION AND MAINTENANCE
OF VENTILATING FANS

1. GENERAL

1.01 This section outlines procedures for inspecting and maintaining large ventilating fans. Small floor or wall type fans are not included. When available, manufacturers' maintenance instructions should be used in conjunction with the information listed herein.

1.02 There are two general types of fans:
(1) centrifugal or radial flow, and (2) axial flow or propeller type illustrated in Figs. 1 and 2, respectively.

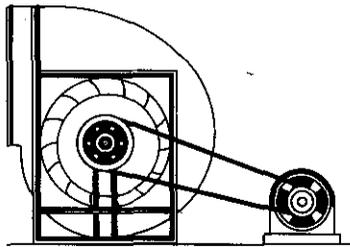


Fig. 1 - Typical Centrifugal Fan

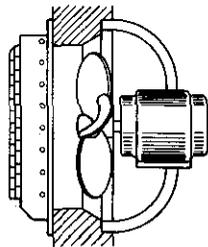


Fig. 2 - Typical Axial Flow Fan

1.03 Centrifugal fans are used almost exclusively in systems where air must be moved through ducts.

1.04 Centrifugal fans are classed, depending on the inclination of the rotor blades, into two general types as illustrated by Figs. 3 and 4.

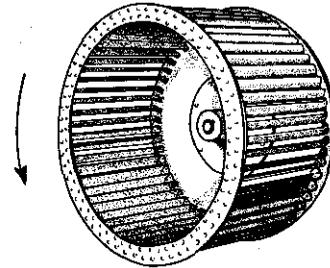


Fig. 3 - Forward Inclined Blades Viewed from Inlet Side

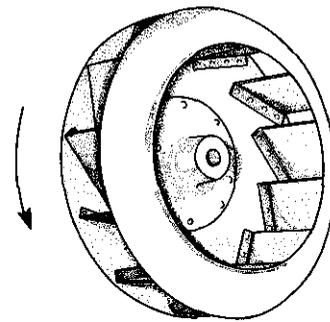


Fig. 4 - Backward Inclined Blades Viewed from Inlet Side

1.05 The slope or angularity of the blades determines the operating characteristics of a fan; a forward-curved or sloped blade is found in a fan having low speed characteristics, while a backward-curved or sloped blade is found in a fan having higher speed operating characteristics.

1.06 Axial flow fans are made with various numbers of blades of a variety of shapes, and are suitable where large quantities of air are required to be moved against little or no static pressure or resistance. In general fans of this type are designed to move the maximum amount of air possible with the least possible noise.

1.07 When handling ventilating fans, the following precautions should be observed:

- (a) Avoid, by careful handling, the dropping or jarring of small completely assembled units. Lift units by the base only and not by the shaft coupling, motor or fan housing.

(b) Special care should be exercised in handling dismantled individual parts, such as the fan wheel, housing, shaft and bearings to prevent their mechanical distortion.

(c) Fan wheels and assemblies are factory balanced to give smooth and vibrationless operation. If the fan wheel is damaged or a shaft is dropped and bent, rebalancing of the assembly, after repairs will generally be found necessary.

(d) A fan wheel should never be lifted by, or allowed to rest its entire weight on, the side plates or blades. The fan wheel and shaft assembly can be lifted by slings around the shaft on each side of the wheel so the wheel is supported by its hub. If a chain is used there must be sufficient padding on the shaft and wheel to prevent scoring of the shaft or damage to the wheel. The chain or slings should be spread with timbers, or braced by some other method to prevent damage to the wheel side plates. If the fan wheel is received separate from the shaft, a suitable bar should be placed through the hub for lifting, making sure not to damage the finished bore of the wheel.

1.08 Fans placed in storage or laid up for an extended interval should be protected against moisture, corrosion and the accumulation of dirt and dust. Wheels should be blocked to prevent their rotation by natural draft or stack effect. Periodic inspections of these fans should be made to insure that no damage is developing.

2. SAFETY

2.01 A ventilating fan can be a very dangerous piece of equipment to perform work on unless certain safety precautions such as the following are observed:

(a) Before starting to work on a fan, be sure the motor disconnect switch is in the open position, and then remove the fuses. To lessen the possibility of these fuses being inadvertently replaced by other employees while the work is in progress, it is suggested that the employee doing the work should carry them on his person until the work is finished.

(b) When deemed necessary and where the fan is subject to a natural draft or stack effect which may cause the wheel or blades to rotate they should be blocked, when at a complete standstill, with a suitable piece of wood (2 x 4).

(c) Never operate a fan unless the belt guard is securely in place. If the guard must be removed to perform certain work operations, it should be replaced before the fan is restored to service.

3. INSPECTION

Dirt

3.01 Although the air which reaches the fan is usually relatively clean, it always contains a quantity of finely divided dust. Over a long period of time this dust frequently accumulates in a dense layer on the forward surface of the rotor blades. Such accumulations, by altering the shape of the surface of the blades, reduce the efficiency of the fan. An accumulation of dirt can also cause a centrifugal unbalance in the fan, Fig. 5. Any substantial amount of dirt should not be allowed to build up on the blades or fan housing.

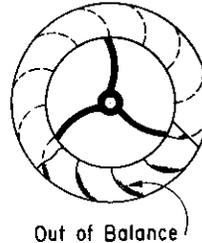


Fig. 5 - Dust Accumulations Cause Wheel Unbalance

Excessive Vibration

3.02 An excellent indication of fan trouble is excessive vibration. The amount of vibration to be termed excessive must be determined from experience with each type of fan. There are no fixed rules on allowable vibration.

3.03 When a fan exhibits excessive vibration, the following probable causes should be checked:

- (a) Alignment and level.
- (b) Shaft bent.
- (c) Wheel or sheaves loose on shafts.
- (d) Loose or worn bearings.
- (e) Loose foundation bolts.
- (f) Motor out of balance.
- (g) Fan or motor sheaves out of balance.
- (h) Coupling misalignment.

3.04 If the vibration is not due to any of the above causes, check the fan wheel for worn blades and for the accumulation of dirt, paint, or other foreign material.

Bearings

3.05 The bearings of ventilating fans are usually either the oil ring or the ball bearing type as illustrated by Figs. 6 and 7. Ball bearings may be either the grease or oil lubricated type. All bearings must receive periodic attention. When inspecting bearings, the following items should be checked:

- (a) The bearings are properly aligned.
- (b) No lubricant is dripping from the bearing.
- (c) Bearing temperature is not excessive. Fan bearings generally should run cool enough to allow hand contact.

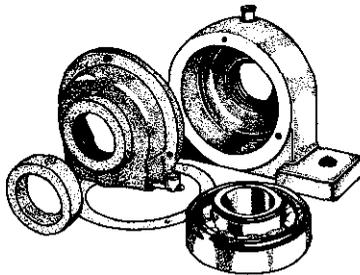


Fig. 6 - Disassembled View of Pillow Block Ball Bearing

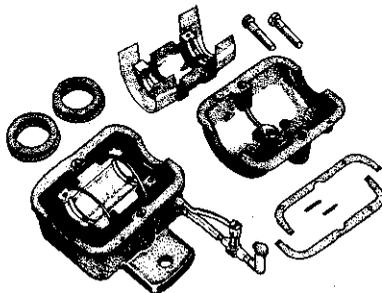


Fig. 7 - Disassembled View of Self-aligning Ring Oiling Bearing

Oil Ring Bearings

(d) Oil ring bearings are lubricated with the proper type oil as listed in Paragraph 4.04(g). The oil level in the gauge shall be:

- Min. 1/2 full
- Max. 3/4 full

- (e) When checking the oil level in a bearing the shaft should not be turning or a false oil level may be indicated.
- (f) The oil has been replaced with fresh oil within at least two years.
- (g) Oil rings turn and deliver oil to the shaft and bearings.
- (h) Oil gauges are free from leaks, and glass gauges, where provided, are free from cracks.

Ball Bearings

- (i) The bearing contains the proper amount of lubricant. A grease bearing should be 1/3 full. A greater amount may cause bearing failure.
- (j) The bearing has been relubricated within three years.

Wheel

3.06 The wheel or rotor of the fan should be inspected for the following items:

- (a) With the power off, the wheel is rotated by hand to assure its easy movement.
- (b) There is ample clearance between the wheel and housing so that the wheel does not strike the housing.
- (c) Excessive corrosion and erosion because these defects may cause the wheel to collapse.

Drives

3.07 The two main types of drives between a fan and motor are V-belts and direct coupling. The items to be checked when inspecting each are listed below:

V-Belts

- (a) Proper tension in all belts.
- (b) No foreign material on belts.
- (c) Sheaves are aligned.
- (d) Excessive belt wear.
- (e) Belt guard is properly installed.

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to be sure that the shaft is not bent. The only sure way to check for slightly bent shaft is with a shaft indicator. With long heavy shafts it is sometimes necessary to take the shaft out of the fan and put it in a lathe to check.

5.03 If an unbalanced fan is allowed to run, it will gradually get worse by loosening foundation bolts, pounding and burning out bearings, springing shaft and possibly damaging the fan wheel itself.

5.04 Fan balance can be determined by chalking the shaft. This method of balancing is a trial and error method and requires no elaborate equipment. Clean shaft and hold sharply pointed chalk stick so that the point just touches the shaft when the fan is running. This will scribe a line on the shaft. The length of line will depend on the amount of unbalance. A short line will indicate the fan is badly out of balance. When the fan is in balance a line will be all around the shaft. Make 3 or 4 lines on the shaft so that an average reading can be taken.

5.05 Take for an example a single width fan, overhung wheel type as illustrated by Fig. 9 (both bearings on the same side of the fan). Run the fan up to speed and chalk the shaft between the inboard bearing and the fan. Then stop the fan and turn the wheel by hand to see how long and heavy the marks show. The heavy side will throw out so that the marks will show up on the heavy side. A weight is then usually required on the heel of the blade opposite the heavy side or 180 degrees away.

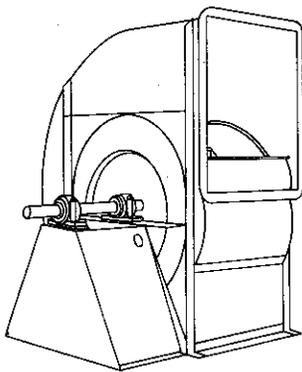


Fig. 9 - Typical Single Width Fan

5.06 A double width or center plate type fan has to be treated a little differently. A fan of this type, as illustrated by Fig. 10, has one bearing on each side of the fan and has to be chalked on each side between the bearing and wheel as in reality two wheels have to be balanced at the same time, and one side affects the other if not carried out this way. Now with marks on both sides of the fan, see if the marks are on the same side of the shaft. If so, weights are usually used on each side of the wheel same as in Paragraph 5.05. If marks shift, the weights are moved till best results are obtained.

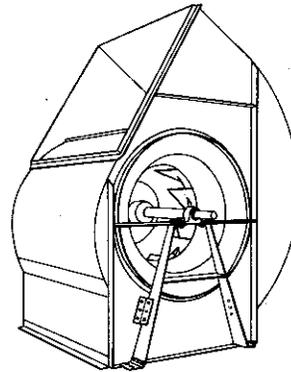


Fig. 10 - Typical Double Width Fan

5.07 A single width fan with a bearing on each side can usually be treated the same as outlined in Paragraph 5.06.

5.08 The balancing of large ventilating fans is usually a project requiring the assistance of the fan manufacturer.

6. MAINTENANCE AND INSPECTION RECORD

6.01 For scheduling and recording maintenance information for ventilating fans, refer to Section H51.350 "Building Mechanical Equipment Scheduling Routine Maintenance."