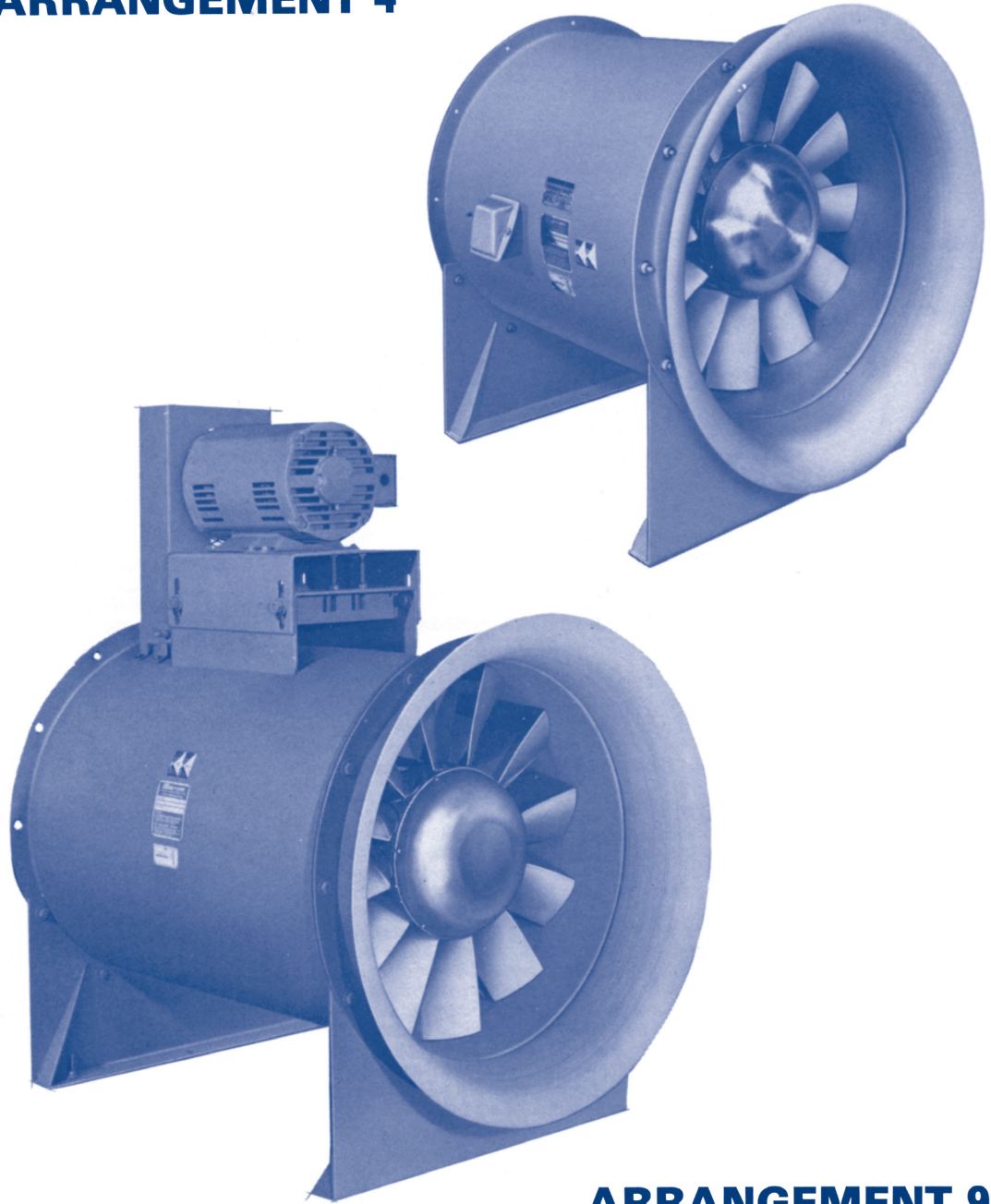


**SAFETY — INSTALLATION — OPERATING
AND MAINTENANCE INSTRUCTIONS
ADJUSTABLE PITCH VANE AXIAL FANS**

VAV VARIABLE AIR VOLUME **FANS**

ARRANGEMENT 4



ARRANGEMENT 9

An ISO 9001 Company

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VAV Vaneaxial Fan Installation and Instruction Manual

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A. Description of Equipment

A-1 General:

The Chicago Blower Corporation VAV fan is a high performance, variable pitch, vaneaxial fan. It is a quality product that with proper care should give you many years of satisfactory operation.

A-2 Adjustable pitch — Arrangement 4

The adjustable pitch VAV fan has a cast aluminum hub and individually adjustable cast aluminum airfoil blades. The casing is accurately formed with integrally rolled inlet and outlet flanges. Casing is complete with guide vanes, inner fairing ring, and motor bulkhead, which is machined to receive a NEMA "C" face TEAO electric motor. The adjustable pitch rotor is mounted on the motor shaft by use of a split-taper lock Q.D. bushing. Blade adjustment is made when the fan rotor is at rest and without removal of the nose spinning. A "blade position index" is stamped on the hub next to each individually adjustable blade and an index mark is stamped in the skirt of each blade. To change the angle of attack of the blade; merely loosen the allen head set screw located at the root of the blade near the leading edge; set the index mark at the required blade setting number; and retighten the set screw.

(CAUTION: Do not set blade angles to a higher number than appears on the nameplate on the fan casing or you may overload the motor.)

The major components of the direct drive adjustable pitch fan are detailed on page 5.

A-3 Adjustable Pitch — Arrangement 9

This VAV fan has the same adjustable pitch wheel as the Arrangement 4 fan but is a V-belt driven unit with the motor mounted on the exterior of the fan casing on an adjustable motor base. The rotor is mounted on the fan shaft by use of a split-taper lock Q.D. bushing. The inner fairing is extended to enclose and protect the fan shaft and bearings. The V-belt drive is isolated from the airstream by a belt tube which is weld-

ed to the inner fairing and the fan casing. The major components of the belt drive adjustable pitch fan are detailed on page 6.

A-4 Accessories

Various accessories are available for the VAV fan.

1. Inlet Bell — steel or aluminum spinning, flanged to mate with fan inlet flange. Inlet bells improve air flow into fan and must be used on open inlet fans to achieve catalogued performance.
2. Guard Screen — heavy gauge wire welded to radial supports, guard screens can be supplied for inlet bells, inlet or outlet cones, or the fan itself.
3. Supports — heavy steel plate reinforced for rigidity is used for fan supports. Supports can be:
 - i. — horizontal feet for floor mounting.
 - ii. — horizontal lugs for ceiling suspension.
 - iii. — vertical lugs for vertical mounting.
4. Inlet/Outlet Cones — generally used on fan outlet to reduce air velocity and consequently the velocity pressure, cones may also be used on the inlet of the fan.
5. Spool piece — heavy gauge steel casing, flanged both ends, and the same diameter as the fan is generally used with access door to provide access to ducted fan.
6. Companion Angle Rings — rolled from heavy steel angles to the same diameter as the fan and used in conjunction with flexible connections.

B. Installation and Start-Up

B-1 Receiving

Chicago Blower Corporation equipment is prepared for shipment in accordance with the Uniform Freight Classification. It is thoroughly inspected at the factory and, barring damage in transit, should be in perfect condition upon arrival.

When a carrier signs the Chicago Blower Corporation's bill of lading, the carrier accepts the responsibility for any subsequent shortages or damage, evident or concealed, and any claim must be made against the carrier by the purchaser. Evident shortage or damage should be noted on the carrier's delivery document before signature of acceptance. Inspection by the carrier of damage evident or concealed must be requested. After inspection, issue a purchase order for necessary parts or arrange for return of the equipment to CBC factory for repair.

B-2 Handling

Chicago Blower Corporation fans are shipped completely assembled and skidded. These units may be handled and moved, using good rigging techniques, being careful to avoid concentrated stresses that will distort any of the parts.

B-3 Safety Precautions

The fan which you have purchased is a rotating piece of equipment and can become a source of danger to life or cause injury if not properly applied. The maximum operating temperature and speed for which this fan is designed must not be exceeded. These limits are given in our catalog, or in the order write-up, or on Chicago Blower Corporation drawings.

Personnel who will operate or maintain this fan should be given this bulletin to read and warned of the potential hazards of this equipment.

This pamphlet contains general recommendations, but specific requirements may apply to the individual installation. Such requirements are outlined in federal, state and local safety codes. Strict compliance with these codes and strict adherence to these installation instructions are the responsibility of the user.

B-4 Storage

If not installed immediately, this fan should be protected to remain dry at all times.

For extended storage:

1. Use area which is dry, protected from low temperature, rapid and extreme changes in humidity, and free from vibration. Rotor should be blocked to prevent windmilling.
2. Every 90 days, the rotor should be turned several revolutions.
3. Every 6 months — add grease to bearings to purge and replace old grease.
4. If motors are equipped with space heaters, make them operable.
5. Motor windings should be megged at time of storage and at removal from storage. The resistance reading at removal must not have dropped more than 50% of the initial reading. If the drop is more than 50%, the motor must be dried electrically or mechanically.
6. Upon removal from storage, bearings should be regreased with an ample supply of fresh grease to purge and replace old grease.

B-5 Vibration Isolation

When your VAV fan is energized, it generates a thrust force which causes the fan to be displaced opposite to the direction of air flow. This force must be resisted to maintain duct alignment and to protect the flexible connectors. Some installations, particularly horizontal units with long hanging rods, may require snubbers to limit the fan movement.

B-6 Free Inlet

VAV fans with open inlets require the use of an inlet bell or inlet cone. Published fan performance is based on the use of an inlet bell. Operation of unit with bare open inlet will result in decreased performance and increased noise.

B-7 Outlet Cone

The VAV Vaneaxial fan is inherently a high velocity air moving device so it is quite common to utilize a diverging cone on the fan discharge to minimize the velocity pressure loss and regain static pressure.

The use of an outlet cone enables more of the fan's pressure capability to be available to overcome system static pressure.

B-8 Flexible Connections

All ducts should be closely aligned with the fan and flexible connections provided between the fan and duct to prevent structure borne noise from being transmitted through the ductwork.

Axial fans, since they require the air to enter the wheel unobstructed, require special care in the installation of inlet flexible connections. Since the inlet side of the fan is under negative pressure, construction material tends to be sucked inward disrupting the flow of air to the wheel and reducing fan performance. The thrust of the fan aggravates this situation in that the fan tends to move forward against the direction of the air flow when it is operating. Flexible connections made at the large diameter of inlet belts and/or cones eliminate this problem.

B-9 Fan Mounting Hardware

All hardware used in the field for support or connection of your VAV fan should be a minimum of Grade 5 quality.

B-10 Electrical

The motor leads terminate in the conduit box mounted on the exterior of the fan casing. Rigid conduit should be run from the motor starter to the fan with a short section of flexible conduit at the conduit box to allow for fan movement.

Wire size and motor overloads should be sized in accordance with the motor nameplate electrical data. On Arrangement 4 fans, a motor nameplate is located on the casing adjacent to the Chicago Blower nameplate. The WR² of your VAV fan is quite low, in comparison with comparable centrifugal fans, with a start-up time of the magnitude of 3-6 seconds. The VAV fan and motor is capable of across-the-line starting, however, reduced voltage starting may be required by local conditions or limitations.

B-11 Start-up Check List

After the equipment has been installed correctly and a check has been made for tightness of all hardware and mounting bolts, the fan will be ready to operate after these final safety checks to prevent injury to personnel or damage to the equipment.

1. Check for correct supply voltage and motor overloads.
2. Remove all tramp material from fan, duct, and in front of fan intake.
3. Check blade pitch setting against nameplate.
4. If belt driven fan, check alignment of belts and sheaves.
5. "Bump" motor to check for fan rotation. Rotation is CCW looking into the fan.
6. Start fan. Check motor amperage in each phase for balance and correct motor load.
7. Check for vibration and any unusual noise.

B-12 Mounting Accessories/Ductwork

Chicago Blower requires that all appurtenances, including ductwork or stacks, which are attached to the fan inlet or outlet, be independently supported, unless prior approval has been obtained from Chicago Blower. Excess dead loads or wind loads can distort the fan housing causing misalignment and possible failure. Flexible connections are also necessary to prevent duct expansion or movement from adding loads to the fan.

C. Maintenance

C-1 General

The basic design and precision construction of Chicago Blower VAV fans are intended to provide long, trouble-free life. Wheels are statically and dynamically balanced after assembly and the completely assembled fan is given a running balance before final inspection/shipment.

To insure long life and trouble-free service, routine maintenance and inspection should be observed. Your VAV fan has been lubricated prior to shipment from the factory and should be relubricated per the proper schedule after start-up. Motor and bearing manufacturers' recommended schedules are packed with the fan.

Mixing of lubricants is not recommended.

Cleanliness is very important in lubrication. Any grease used should be fresh and free from contamination. Similarly, care should be taken to properly clean the area around the grease inlet to prevent contamination.

Maintenance personnel should be alert for excessive vibration or any unusual sounds in the equipment. If the fan is to remain idle for an extended period, it is recommended that the exposed surfaces be covered with a protective coating. Bearings should be protected in line with the manufacturer's recommendations and the wheel should be rotated periodically.

C-2 Lubrication – Arrangement 4

In an Arrangement 4 VAV fan, the motor is the heart of the unit and particular care should be taken in maintenance of the motor to insure a long and continuous operating life. The unit should be checked periodically for vibration and any unusual noises.

There are two bearings in the motor, so two grease leads extend from the motor to the outside of the casing. These leads are terminated with standard grease fittings.

The following procedure should be followed for proper lubrication:

1. Stop motor and lock out the switch.
2. Locate the grease inlet fittings. Clean the area thoroughly, remove plastic caps from grease fittings.
3. Add the recommended volume* of the recommended lubricant* using a hand operated grease gun. If possible, rotate the fan wheel by hand during greasing.
4. Remove excess grease and purged grease from area and replace plastic grease fitting caps.
5. Run motor for at least one hour.
6. Clean up any purged grease.
7. Return unit to operation.

* The various motor manufacturers have different recommended volumes and types of grease. Check the motor manufacturer's instructions, packed with the fan, before lubricating the motor.

C-3 Lubrication – Arrangement 9

In an Arrangement 9 VAV fan, both the fan bearings and the motor bearings need to be included in your planned maintenance schedule. The fan unit should be inspected periodically for any unusual noises or change in vibration.

The two fan bearings have grease leads extended to the outside of the fan casing. These leads are fitted with standard grease fittings.

The following procedure should be followed for proper lubrication.

1. Stop motor and lock out the switch.
2. Locate the grease inlets and reliefs on the motor and clean the area of dirt and contaminated grease. Grease the motor per the recommendation of the motor manufacturer.
3. Locate the grease inlets in the fan casing and clean the area of dirt and contaminated grease. Remove plastic cap from grease fitting.
4. Lubricate the bearings per the manufacturer's instructions packed with the fan.
5. Add lubricant slowly and rotate fan wheel during lubrication, when possible and where good safety practice permits.
6. Replace plastic grease fitting caps and clean excess grease from area.
7. Return unit to operation. Unit should be watched for several hours for proper operation.

C-4 Grease Lead Location

On the Arrangement 4 VAV fan, the grease inlet fittings are located on the outside of the fan casing within 15° of the electrical conduit box. All two fittings are in the same area. The leads have standard grease fittings.

On the Arrangement 9 VAV fan, the grease leads are brought to the outside of the fan through the belt tunnel. The grease fittings are attached to clips which are welded to the adjustable motor base. The two fittings are located 180° apart.

D. Disassembly and Assembly

D-1 Adjustable Pitch – Arrangement 4

Warning: Disconnect all power sources from fan to avoid electrical shock and personal injury from rotating parts.

D-1-a Wheel Removal

1. Remove nose spinning from hub. Spinning is attached to hub by either six (A Hub) or eight (B, LB & C Hubs) screws located around the periphery of the hub.
2. Remove hex head bolts securing hub to Q-D bushing.

3. Break bond between the rotor and bushing by screwing bolts into tapped holes in hub. Tighten bolts slowly and equally to avoid cocking hub on bushing.
4. Remove hub and blade assembly.
5. If blades are to be removed from hub, matchmark each blade so it can be replaced in the same blade socket and follow steps 5a, 5b, 5c and 5d.
 - 5a. Loosen set screw located in blade skirt adjacent to leading edge of blade.
 - 5b. Remove locking ring from the blade retainer halves with the use of external snap-ring pliers (Waldes #0609)
 - 5c. Remove blade retainer halves.
 - 5d. Slide blade from blade socket.
6. If QD bushing is to be removed, locate and mark its location relative to end of shaft to facilitate reassembly, and follow steps 6a, 6b and 6c.
 - 6a. Loosen the two set screws in the QD bushing.
 - 6b. Remove the socket head cap screw (clamp screw).
 - 6c. Slide bushing from shaft.

D-1-b Wheel Reassembly

If QD bushing has not been removed from the motor shaft, start with item #3.

1. Place QD bushing on motor shaft.
 - 1a. Replace and tighten clamp screw to secure QD bushing to motor shaft.
 - 1b. Tighten the two set screws in the bushing.
2. If blades have been removed from the hub, replace in their previously marked sockets.
 - 2a. Replace blade retainer halves.
 - 2b. Lock blade retainer halves in place with locking ring.
 - 2c. Reset blade pitch angle in accordance with data on fan nameplate and secure by tightening set screw in blade skirt.
3. **CAUTION:** Do not lubricate the bushing, bore or bolts. Lubricants on these surfaces may result in hub stresses high enough to fracture the mounted hubs.
Place rotor assembly on QD bushing and secure assembly to bushing with hex head bolts. Tighten bolts slowly and equally to avoid cocking hub on bushing. Torque bolts to the following values:
A Hub – 10 ft. lbs.
B Hub – 40 ft. lbs.
C Hub – 90 ft. lbs.
4. Replace nose piece.
5. Follow start-up check list (Section B-11)

D-1-c Motor Removal

In order to remove the motor from the VAV fan, A/4, it is necessary to have access to both the inlet and discharge of the unit.

1. Remove hub and blade assembly per instructions in Section D-1-a.
2. Remove conduit box cover and disconnect all wiring.
3. Remove remainder of conduit box from fan casing.
4. Disconnect conduit pipe between fan casing and motor and remove. Be careful in removing conduit that motor leads are not damaged.
5. Disconnect and remove external lubrication lines.
6. Some large horsepower motors have “stay bolts” between the fan casing and motor at the “opposite shaft” end of the motor. Remove “stay bolts”.
7. Block motor securely so it is not damaged when motor mounting bolts are removed.
8. Remove motor mounting bolts. Bolts are removed from inlet side of fan. Bolts extend through the motor mounting plate into the C-face of the motor.
9. Remove motor from fan casing through discharge end of fan.

D-1-d Installing Motor

1. Place motor into fan casing through the discharge end of the fan. The C-face of the motor fits into the machined recess in the motor mounting plate.
2. Secure motor to mounting plate with motor mounting bolts. Bolts are replaced from the inlet side of the fan. Bolts extend through the motor mounting plate into the C-face of the motor. If original bolts are not used, insure that the replacement bolts are minimum Grade 5 quality.
3. Replace “stay bolts” if required.
4. Replace and connect external lubrication lines.
5. Thread motor leads through conduit pipe and replace and connect conduit pipe to motor and fan casing.
6. Replace conduit box and reconnect all wiring.
7. Replace conduit box cover.
8. Replace wheel assembly per Section D-1-b.
9. Follow start-up check list (Section B-11).

D-2 Adjustable Pitch – Arrangement 8

Warning: Disconnect all power sources from fan to avoid electrical shock and personal injury from rotating parts.

D-2-a Wheel Removal

See Section D-1-a

D-2-b Wheel Reassembly

See Section D-1-b

D-2-c Bearing Removal

1. Drive end bearing can be replaced without removing wheel from shaft if care is taken in removing it. Replacement of wheel end bearing requires wheel to be removed per Section D-1-a.
2. Remove inner fairing cover from drive end of fan and disconnect and remove V-belt.
3. Remove fan sheave from shaft.
Note: Depending on fan size and horsepower, some Arrangement 9 fans have flange mounted bearings and others have pillow block bearings. Instruction are similar for both types. When pillow block bearings are removed, mark and save any shims so they can be replaced in the same position.
4. If drive-end bearing only is to be removed, follow instructions in 4a, 4b and 4c.
 - 4a. Block shaft securely to prevent damage to wheel and bearing when drive-end bearing is removed.
 - 4b. Loosen Allen-head bolts in bearing locking collar.
 - 4c. Remove bearing mounting bolts and carefully slide bearing from shaft.
5. If both bearings are to be removed, follow instructions in 5a, 5b, 5c and 5d.
 - 5a. Remove wheel assembly per Section D-1-a.
 - 5b. Loosen Allen-head set screws in bearing locking collars.
 - 5c. Slide shaft from bearings.
 - 5d. Remove bearing mounting bolts and remove bearings.

D-2-d Bearing Replacement

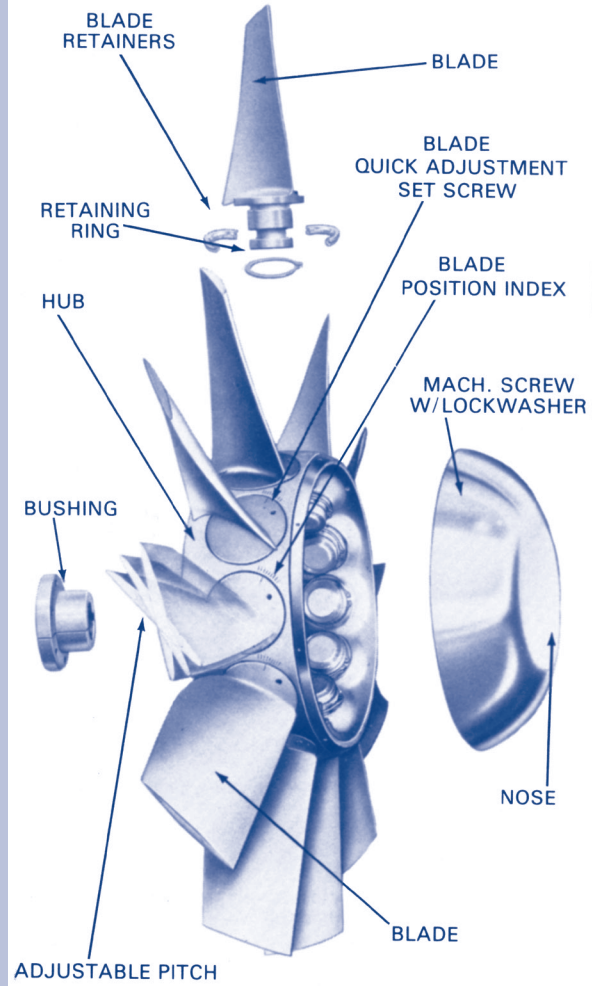
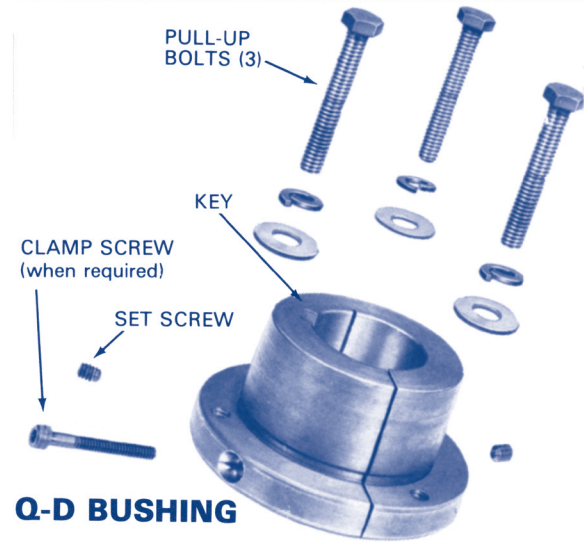
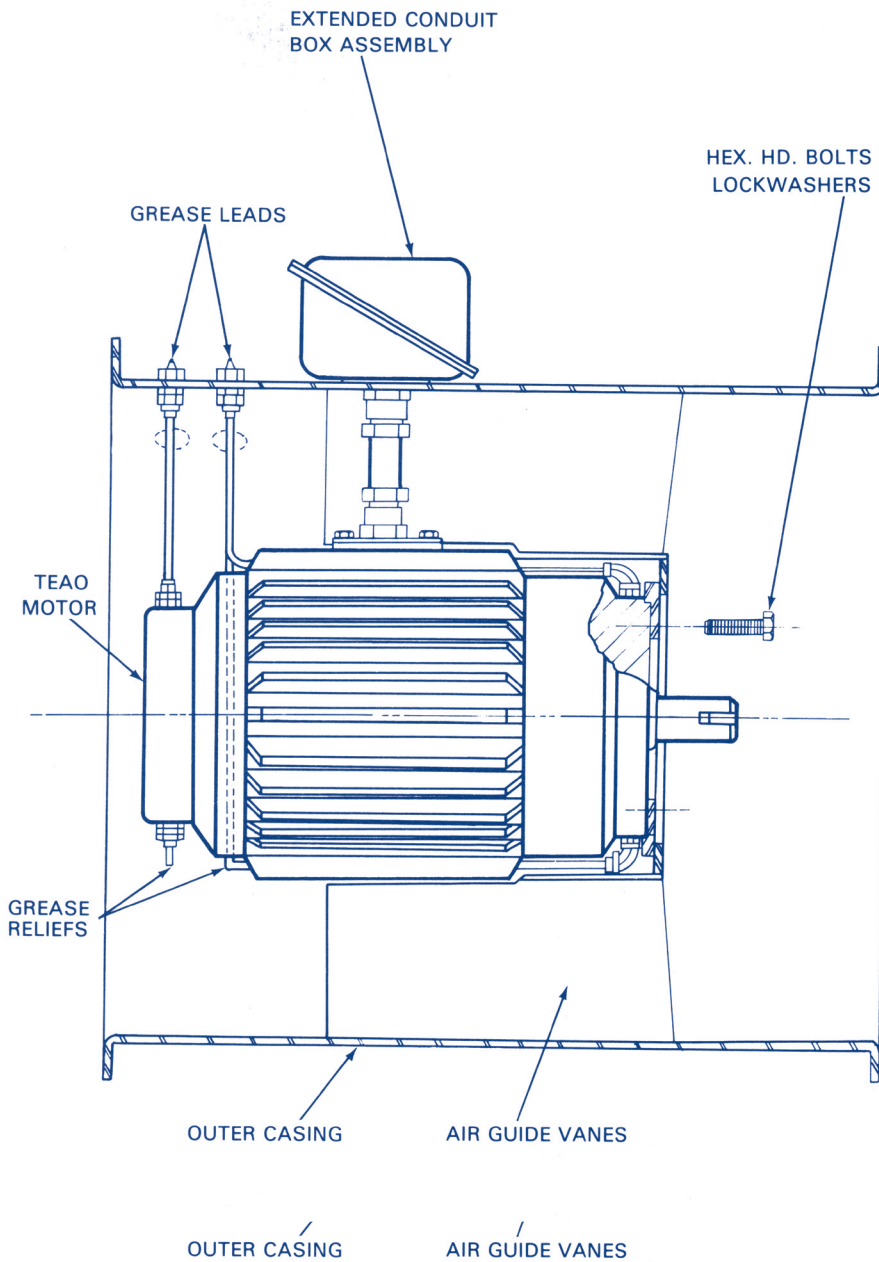
1. Replace bearings and snug up bearing mounting bolts. Do not tighten securely. If pillow block bearings are used, replace any shims in their proper location.
2. Slide shaft into bearings, position for axial location and tighten set screws in locking collar.
3. VAV fans have a close tip clearance between the blade tips and housing, so centering of shaft in the housing is critical. Attach “sweep arm” to shaft in rotor tracking area and adjust bearing position to assure uniform tip clearance around the housing.
4. Secure bearing mounting bolts.
5. Check axial location of shaft and adjust as necessary.
6. Replace wheel assembly per instructions in Section D-1-b.
7. Replace and align fan sheave and V-belt drive.
8. Replace inner fairing cover.
9. Follow start-up check list (Section B-11).



ARRANGEMENT 4

HUB	TORQUE (FT.-LBS)				
	PULL-UP BOLT	BUSHING SET SCREW	CLAMP SCREW	*BLADE SET SCREW	NOSE SCREW
A	10	4	1.4	.8	.8
B	40	14	8.6	2.5	.8
C	90	30	8.6	4.2	.8

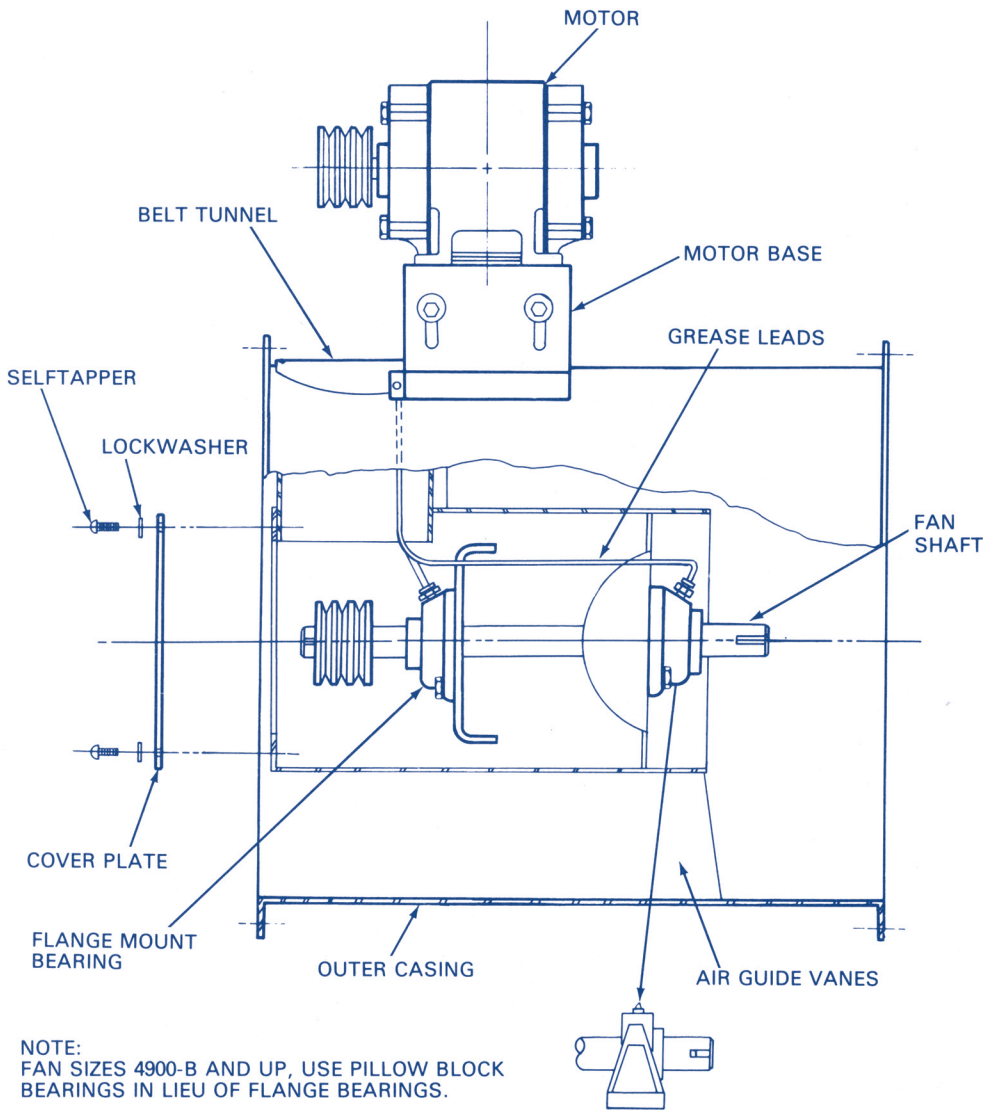
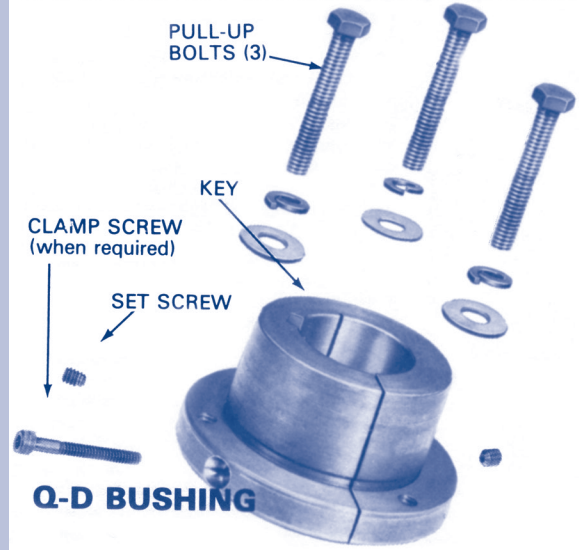
*MAX. - CAUTION - DO NOT OVERTIGHTEN



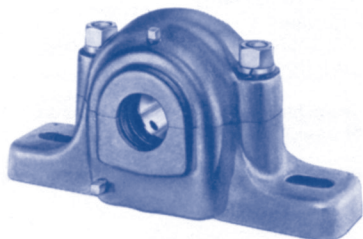
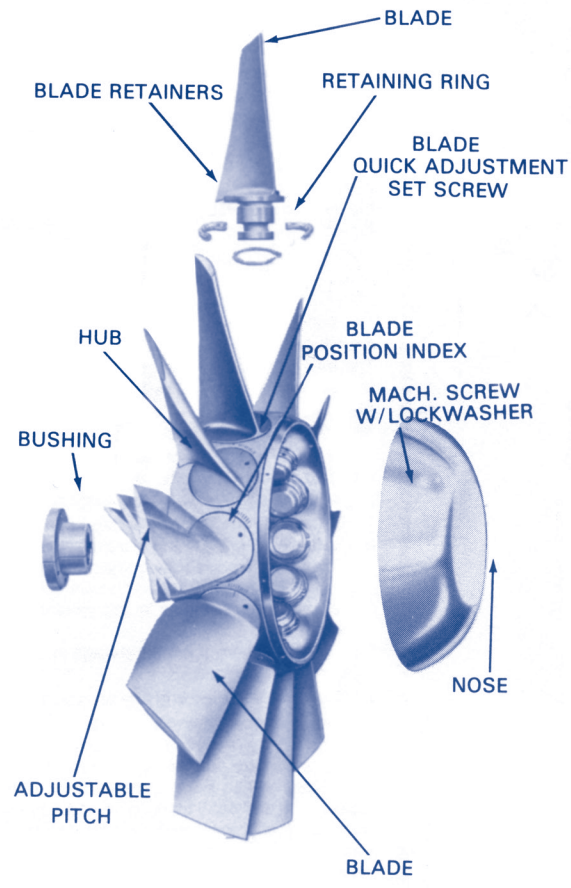
ARRANGEMENT 9

HUB	TORQUE (FT.-LBS)				
	PULL-UP BOLT	BUSHING SET SCREW	CLAMP SCREW	*BLADE SET SCREW	NOSE SCREW
A	10	4	1.4	.8	.8
B	40	14	8.6	2.5	.8
C	90	30	8.6	4.2	.8

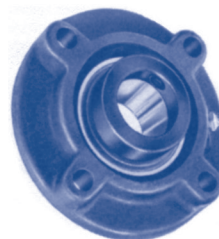
*MAX. - CAUTION - DO NOT OVERTIGHTEN



NOTE:
FAN SIZES 4900-B AND UP, USE PILLOW BLOCK BEARINGS IN LIEU OF FLANGE BEARINGS.



PILLOW BLOCK BEARING



FLANGE MOUNTED BEARING