

HEAVY DUTY FAN EQUIPMENT

SERVICE MANUAL

1. INTRODUCTION

This service manual for Heavy Duty Fan equipment, was prepared by Buffalo Forge Company Engineers to assist you in the erection, operation and maintenance of your fans. Together with the fan assembly drawing, it is intended to give you all necessary information.

The contents are necessarily general and cover most aspects of Heavy Duty Fan equipment. Often the sales catalog pertaining to the respective type

fans will be helpful. For catalogs and further assistance contact your local "Buffalo" Sales Representative.

In many cases, it is advisable to have an experienced Buffalo Factory Serviceman supervise the erection of maintenance. Servicemen are available by arrangement through our sales offices and the cost is often offset by savings in material, labor or downtime.

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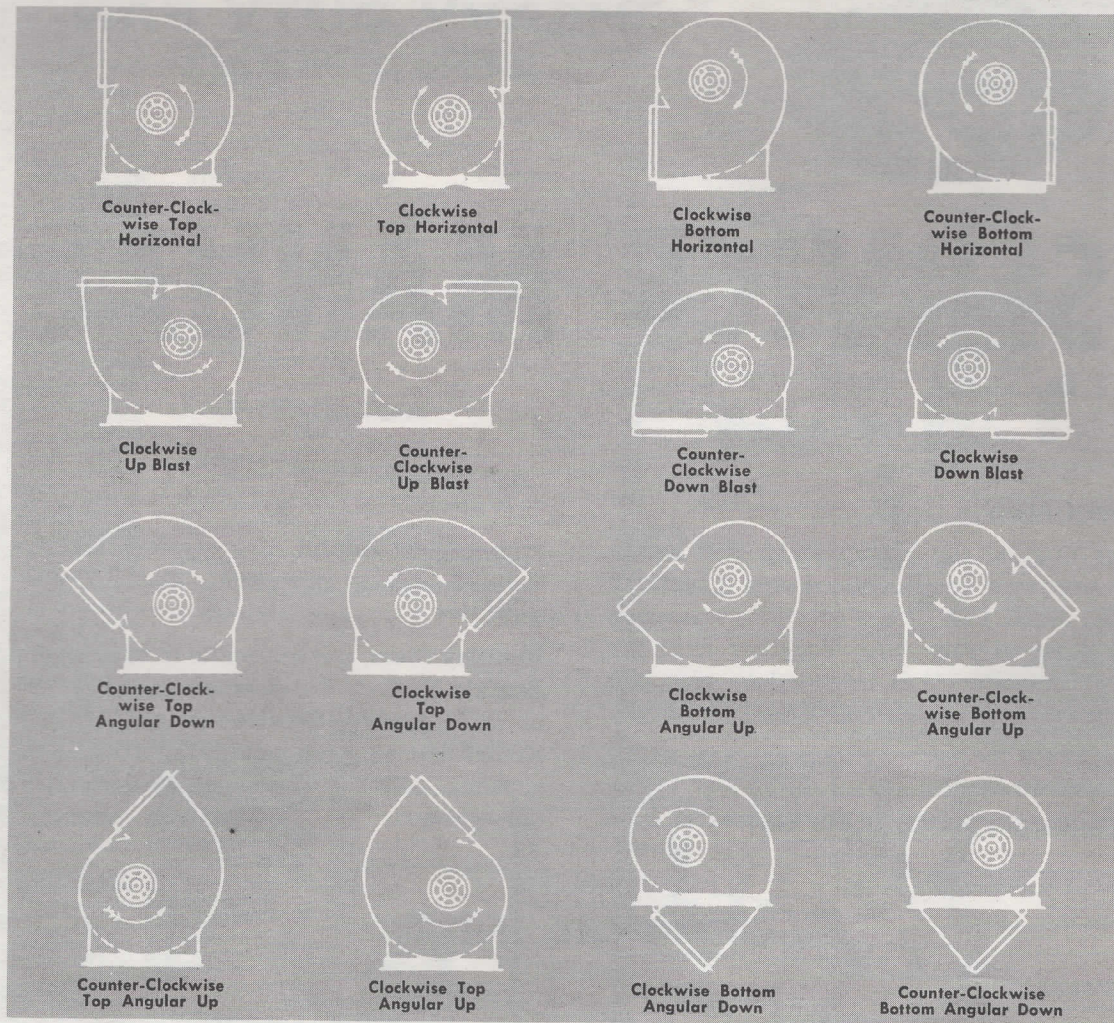
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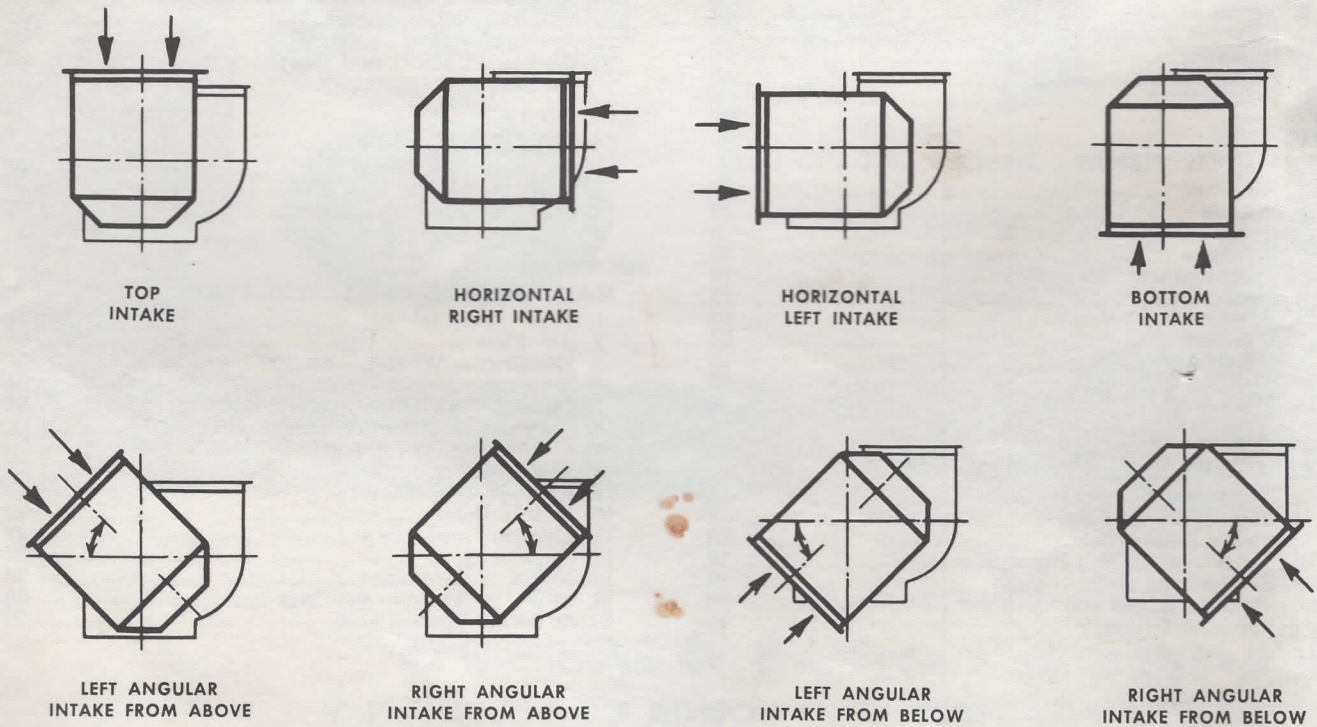
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2. DESIGNATION OF DIRECTION OF ROTATION AND DISCHARGE

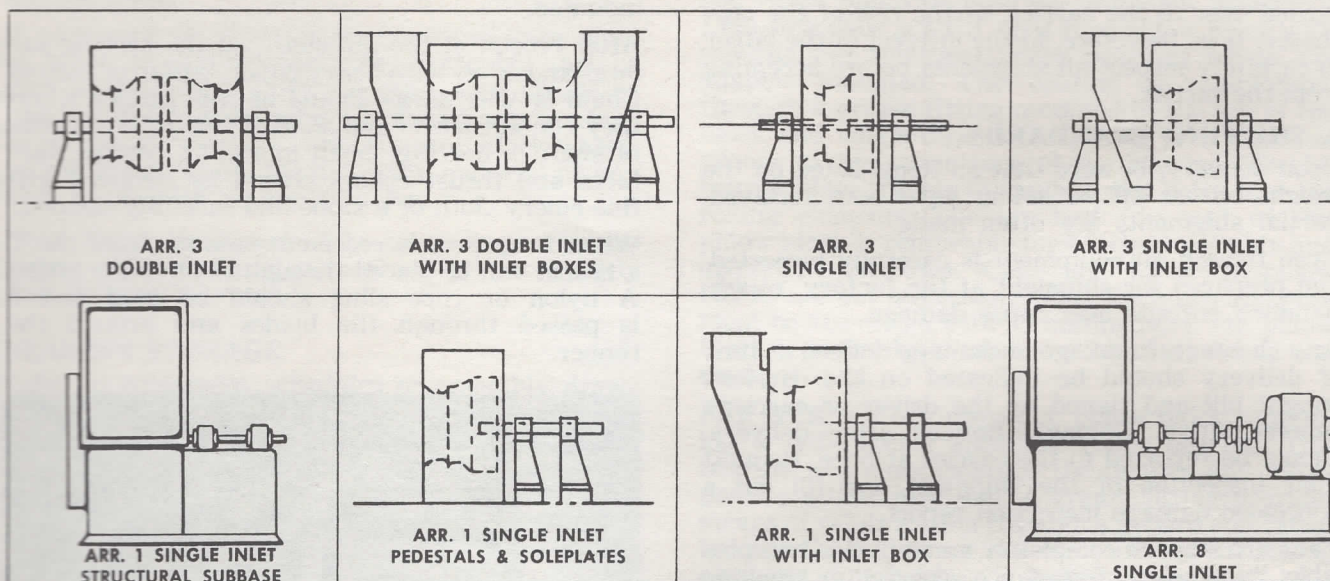


Direction of Rotation is determined from drive side for either single or double inlet fans. (The driving side of a single inlet fan is considered to be the side opposite the inlet regardless of actual location of the drive.) When dual drive is used the drive side is the side of the larger driving unit.

3. STANDARD INLET BOX POSITIONS

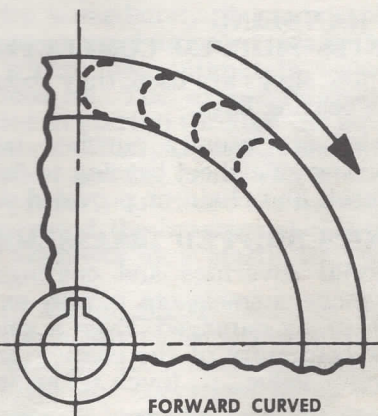
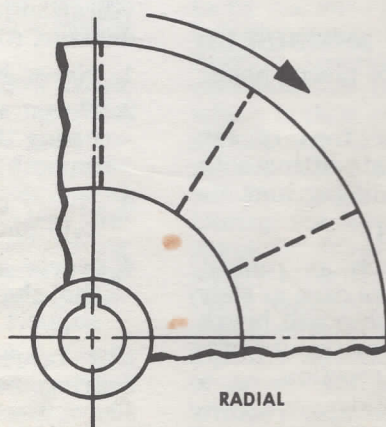
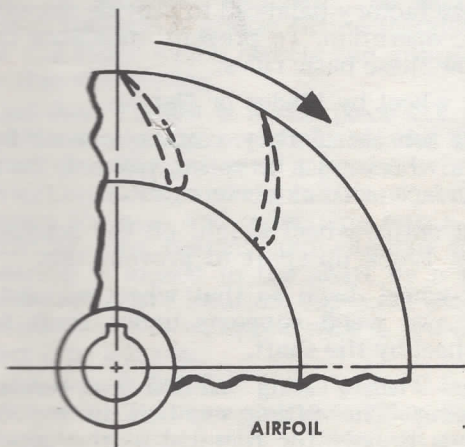
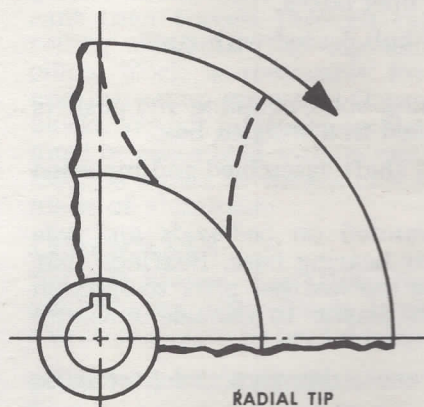
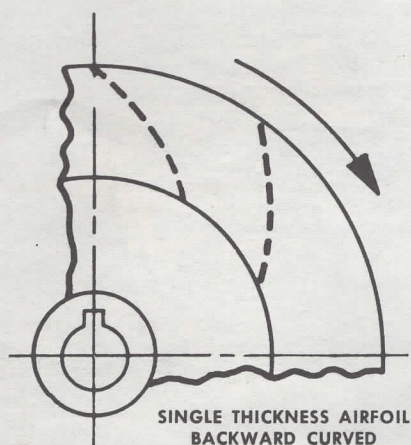


4. STANDARD FAN ARRANGEMENTS



5. WHEEL DESIGNS AND ROTATIONS

Arrows Indicate Proper Direction of Rotation



6. BUFFALO STANDARD TERMS OF SALE

F.O.B. factory, Buffalo, N. Y. with freight allowed as stated in the proposal. Shipments become the property of the purchaser as soon as they are turned over to the carrier, at the risk of the purchaser. It is, therefore, to the interest of the buyer to carefully inspect all shipments before accepting from the carrier.

7. SHIPPING STANDARDS

Upon delivery, be sure that all items listed on the freight bill or bill of lading have been received. Partial shipments are often made.

Even though all equipment is carefully inspected and prepared for shipment at the factory, rough handling enroute may cause damage.

Any shortage, breakage or damage noticed at time of delivery should be indicated on the carrier's freight bill and signed by the driver or carrier's representative. Damage, noticed after delivery, should be reported to the carrier at once. Request their inspection of the shipment and fill out a concealed damage inspection report.

Fans are shipped completely assembled, when possible, in complete accordance with rail or trucking limitations.

Fans with special coatings have inlets and outlets covered during shipment to prevent damage.

All Fans with bearings mounted on independent pedestals are shipped disassembled.

Normal fan sections when shipped disassembled:

1. Housings and/or inlet boxes.
2. Wheel — bore of hub coated with rust preventative.
3. Shaft, keys, housing bolts, coupling and gaskets material are packed in a wooden box.
4. Or . . . wheel and shaft assembled and mounted on a skid.
5. Bearings are mounted on pedestals and sole plates, or on their bearing base. Bearings that will be exposed to the weather prior to erection are covered with plastic to exclude moisture and dirt.
6. Variable inlet vanes, dampers, inlet screens, coupling guard.
7. Large motors, variable speed couplings, and turbines normally are shipped direct from manufacturer.

8. HANDLING

UNITS SHIPPED COMPLETELY ASSEMBLED

Where slings are used, they should be placed under the bearing base.

Holes are usually punched in the tops of fan housing side sheet bracing to facilitate lifting with a hook and chain or provided with lifting lugs.

UNITS SHIPPED DISASSEMBLED

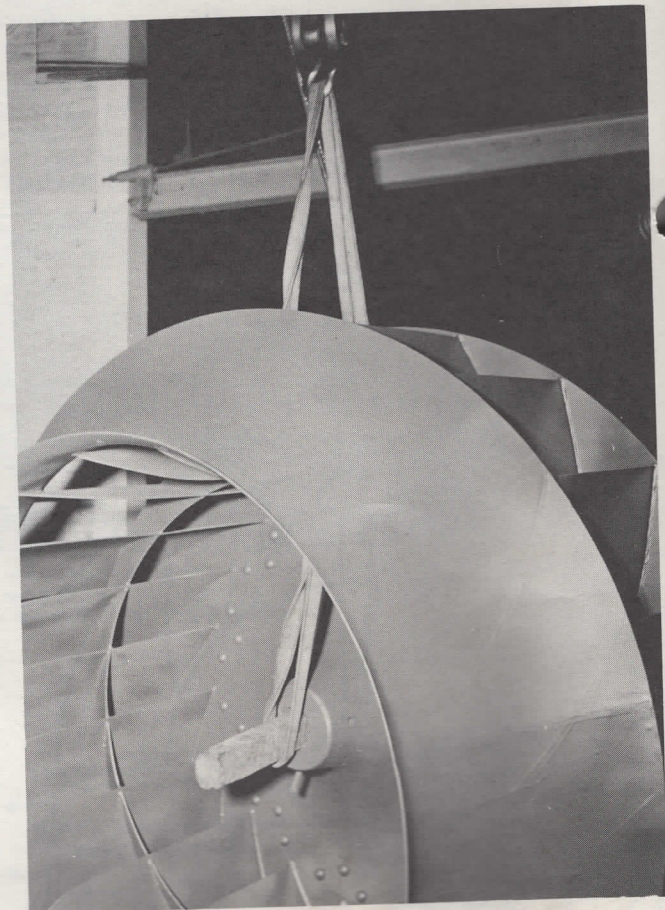
Special coverings and coatings such as rubber, phenolic enamels, etc. require extreme care as they are easily damaged. Even a small chip will break the continuity of the coating and destroy its protective value . . . touch up prior to erection.

Parts of fans shipped disassembled also require special care. In handling the shaft or wheel and

shaft assembly with a hoist or crane, rope slings should be placed around the shaft near the wheel position. NEVER place slings on the ground shaft surfaces where bearings or wheel are to be mounted.

After receipt of the fan shaft, oil the bearing surfaces and cover with heavy paper, burlap or canvas. Chain or wire slings should be well padded where they contact wheel and shaft. Prior to installation of shaft in bearing, small marks on bearing surfaces and thrust collars should be removed with fine emery cloth or a stone and carefully cleaned.

When fan wheel is received separate from shaft, a timber can be placed through the hub for lifting. A nylon or rope sling should be used and it is passed through the blades and around the timber.



Fan wheels are factory-balanced to provide smooth vibration-free operation. To prevent unbalance or damage, follow these basic rules:

1. Never lift wheel by blades or flanges.
2. Never roll wheels if they can be moved by lifting. If a wheel must be rolled, roll only on a smooth surface with extreme caution.
3. Never rest entire wheel weight on the housing side plates. Block up shaft to prevent this.
4. Never set wheel down so that wheel supports the shaft; use wood supports under shaft to support wheel by the shaft.

Lift bearings with a sling around and under bearing housing. The lifting eye-bolt in top of sleeve bearings is only for removal of the upper half of the bearing housing.

9. STORAGE

Store in a dry, protected area being sure fan shaft, bearings and wheel are protected against dust and corrosion.

If necessary to store outdoors special care must be taken to prevent moisture, corrosion, dirt or dust accumulation. Coat the shaft with grease or rust preventive compound. Cover and seal bearings to prevent entrance of contaminants. Block wheels to prevent rotation. Do not allow material of any kind to be piled on top of a fan.

Note: Extra caution must be taken to prevent internal moisture damage to bearings, particularly Anti-Friction bearings.

BEARING STORAGE

Refer to equipment schedules or assembly drawings for type of pillow block bearings mounted on each unit. The method of protecting the bearing during storage will vary depending upon the bearing make and type. Some units are equipped with one piece pillow blocks and others with two piece blocks.

BEARING DESCRIPTION

Fafnir RAK is a one piece C.I. pillow block with ball bearings. The pillow block is self-aligning at mounting with the spherical outside diameter of the bearing fitting into a corresponding spherical housing seat. This unit is prelubricated and ready for immediate use. A grease fitting provides means of relubrication through a groove on the inside surface of the housing. The bearing has a contact type seal and is locked to the shaft with a cam-type locking collar with one soc. hd. cup-point setscrew.

Fafnir LSAO is a one piece C.I. pillow block with a high capacity wide inner ring ball bearing. This block is also self-aligning and relubricatable the same as the RAK. The bearing has a labyrinth type Mechani-Seal and is locked to the shaft with a cam-type locking collar with one soc. hd. cup-point setscrew.

Fafnir SAOL is a C.I. pillow block with felt seals and a removable end cover. Each fan is equipped with one "fixed" and one "floating" bearing. The end covers are not interchangeable from one pillow block to another. The SAOL unit is equipped with a heavy series, self-aligning wide inner ring ball bearing and a cam-type locking collar with one soc. hd. cup-point setscrew. The bearing is lubricated through a grease fitting installed in the top of the block which directs the grease to a cavity within the casting.

Link-Belt P2-300 is a one piece C.I. pillow block with self-aligning, prelubricated ball bearings. The block is equipped with a pressure relief type lubrication fitting and the lubricant passes freely between the seal and outer ring into a reservoir to lubricate the bearing and aligning surfaces. The bearing is locked to the shaft by a steel locking collar with two knurled, cup-point set-screws. The pillow block is equipped with a self-aligning contact type felt seal.

Link-Belt B-22400 is a one piece C.I. pillow block with self-aligning spherical roller bearings. The block is equipped with a labyrinth seal which effectively retains the grease lubricant which has been applied at the factory. Relubrication is ac-

complished through a grease fitting which directs the grease into the center of the rolling elements. The bearing is locked to the shaft by a steel locking collar and two knurled, cup-point setscrews.

Link-Belt 6800 is a C.I. split type pillow block with self-aligning spherical roller bearings which are adapter mounted. The bearing is relubricated through a grease fitting mounted in the top of the block and which directs the grease to an annular groove in the outer race of the bearing. The lubricant then travels through radial holes into the rolling elements. The top half (or cap) of this pillow block is removable for bearing assembly and inspection purposes. Caps and bases of pillow blocks are not interchangeable. Each cap and base must be assembled with its mating part. The pillow block is sealed by means of a labyrinth triple seal made of steel.

SKF SYR is a one piece C.I. pillow block containing a self-aligning spherical roller bearing. This bearing is prelubricated at the factory and incorporates a labyrinth seal. A grease fitting provides means of relubrication through a groove and radial holes in the outer race into the center of the rolling elements. The bearing is locked to the shaft by a steel locking collar with two knurled, cup-point setscrews.

SKF SAF 22500 is a C.I. split type pillow block with self-aligning spherical roller bearings which are adapter mounted. The bearing is relubricated through a grease fitting mounted in the top of the block and which directs the grease to an annular groove in the outer race of the bearing. The lubricant then travels through radial holes into the rolling elements. The top half (or cap) of this pillow block is removable for bearing assembly and inspection purposes. Caps and bases of pillow blocks are not interchangeable. Each cap and base must be assembled with its mating part. The pillow block is sealed by means of a labyrinth triple seal made of aluminum.

LUBRICANTS

Refer to Section V or G1001 for the type of grease used in each pillow block. It is recommended that the same grease be used during relubrication.

BEARING PROTECTION

Each fan equipped with **Fafnir RAK, LSAO, Link Belt P2-300, B-22400 & SKF SYR** pillow blocks has been test run at the factory. These bearings are prelubricated and should not require any additional grease for startup. However, if unit is not to be put into service immediately, it is advisable to add lubricant so as to expel any air voids in the bearing reservoir which may ultimately collect condensation or moisture. The excess lubricant which is then expelled at startup through the seals should not be replaced. This purging action will permit cooler operation and the remaining grease will be adequate to properly lubricate the bearing. During the inactive period the bearings should be protected from the elements by a plastic film securely attached.

Units equipped with **Fafnir SAOL** bearings are also generally test run at the factory. These bearings are lubricated with the recommended amount of grease and are ready for operation. If the fan unit is not to be put into immediate service, the bearing end cap should be removed and, using a clean instrument (fingers will do), the interior sur-

faces of the casting and the exterior surfaces of the bearing should be coated with grease. It is not recommended that the housing cavities be completely packed. During the inactive period, the bearings should be protected from the elements by a plastic film securely attached.

Link Belt 6800 series bearings may be factory or field mounted depending upon fan design and size. If factory mounted, they may or may not have been test run, again depending upon unit size. When factory mounted, the bearings have been lubricated with the correct amount of grease to permit immediate operation upon erection. When field mounted, it should be noted that the bearing was shipped with a preservative only and the bearing must be lubricated before operating. If the fan is not to be put into immediate service upon installation, the pillow block and bearing should be hand packed full of grease being sure that no moisture or dirt particles are entrapped during this procedure. The bearing should then be tagged that it contains too much lubricant for normal operation and covered with a plastic film. When readying the equipment for operation, the bearing cap is to be removed and all lubricant swabbed out with a clean instrument and clean rags. After inspection of the bearing, fresh lubricant should be applied in the specified quantity. Complete greasing is assured if the grease is worked in one side of the bearing until grease appears on the opposite side. Pack the housing reservoir with grease to a height approximately even with the bottom of the shaft.

SKF SAF 22500 series bearings may be factory or field mounted depending upon fan design and size. If factory mounted they may or may not have been test run, again depending upon unit size. When factory mounted, the bearings have been lubricated with the correct amount of grease to permit immediate operation upon erection. When field mounted, it should be noted that the bearing was shipped with a preservative only and the bearing must be lubricated before operating. If the fan is not to be put into immediate service upon installation and the bearing has been factory mounted, the bearing cap is to be removed and the grease removed from the housing and bearing by cleaning out by hand as far as possible and then washing down the bearing and housing with a spray of white kerosene. After the bearing and housing have been washed down with white kerosene to remove as much of the grease as possible in the bearing, the bearing and housing should be blown out with air and dried with clean rags and the bearing and housing sprayed with Houghton Rust Veto 342 or equal. After replacing the pillow block cap, the entire assembly should be carefully wrapped with a plastic film. A tag must then be attached stating that lubricant of the proper amount must be added by the prescribed procedure before start-up. See paragraph above for LB6800 bearings for lubricant amount.

For field mounted bearings, the bearing has not been run, and therefore there is no grease in the pillow block. In this case, the bearing and the inside of the housing should be sprayed with Houghton Rust Veto 342 or equal and when the pillow block cap is replaced, the pillow block housing should be wrapped in plastic and tagged as above. The slushing compound should be left on the bearing. Before startup, the proper amount of grease must be applied as stated above.

PRECAUTION

Extreme care must be taken at all times to insure against the entrapment of foreign particles when working with bearings. Bearings with side or top caps removed should not be left unprotected or unattended at any time.

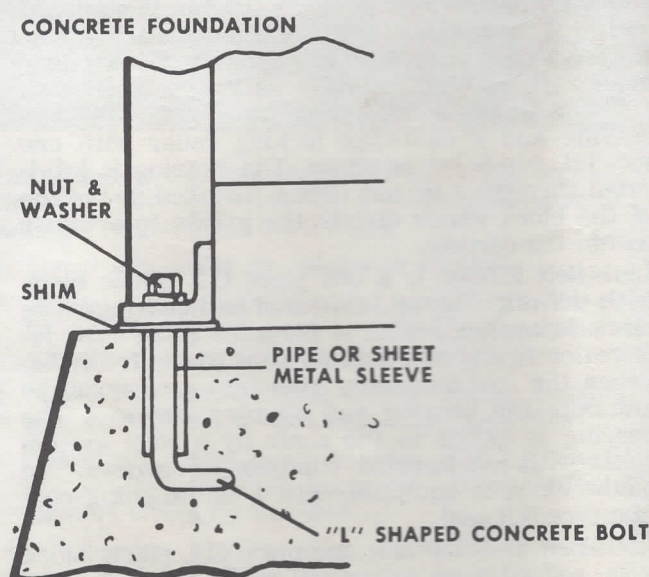
10. FOUNDATIONS

A rigid, level foundation is a must for every fan. It assures permanent alignment of fan and driving equipment and freedom from excessive vibration, minimizing maintenance costs. The sub-foundation (soil, stone, rock, etc.) should be firm enough to prevent uneven settlement of the structure. Foundation bolt locations are found on the assembly drawing. Foundations for high temperature fans must provide for housing expansion.

POURED CONCRETE FOUNDATION

Poured concrete under the fan and all drive components is the better fan foundation. A generally accepted rule of thumb is that the weight of concrete foundation be three times the total weight of the equipment it will support. This weight acts as an inertia block to stabilize the foundation. Where the ground is soft, the foundation should be flared or the footing course increased in size to resist settling. The top of the foundation should extend at least 6 inches outside the outline of the fan base and should be beveled on the edges to prevent chipping.

Anchor bolts in concrete should be L or T-shaped. They should be placed in pipe or sheet metal sleeves approximately 2" larger in diameter than the anchor bolts to allow for adjustment in bolt location after the concrete has set. In estimating the length of bolts, allow for the thickness of nut and washers, thickness of fan base, extra threads for draw down and approximately 1" for grout and shims.

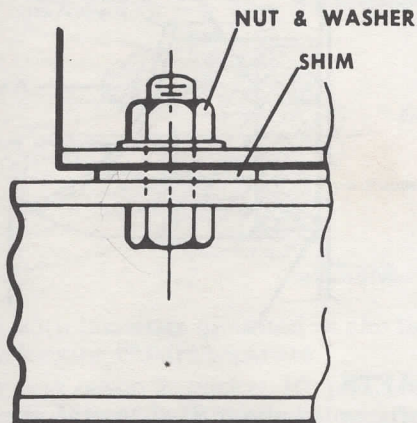


STRUCTURAL STEEL FOUNDATION

When a structural steel foundation is necessary, it should be sufficiently rigid to assure permanent alignment. It must be designed to carry, with minimum deflection, the weight of the equipment plus the loads imposed by centrifugal forces set up by the rotating elements.

The structural foundation should be properly assembled by welding, riveting or the use of structural bolts to prevent vibration.

Fans installed above ground level should be located near to or above a rigid wall or heavy column. An overhead platform or support must be rigidly constructed, level and sturdily braced in all directions.



EQUIPMENT MOUNTED FANS

If the fan is mounted on equipment having parts which cause vibration, it is very important the fan support be rigid enough to prevent such vibration being carried to the fan. The resonant frequency of the support should differ from the fan running speed by at least 10%.

SECTION II

FAN COMPONENTS DESCRIPTION AND DATA

1a. HOUSINGS

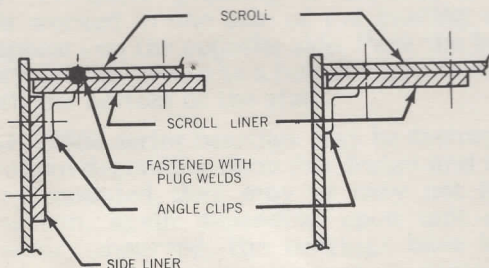
Housing without inlet boxes are of welded construction.

Design for wheel removal can be either through the fan inlet (as in Arrangement 1 fans) or by use of split housing construction. The fan inlet and discharge are flanged for bolting or welding.

Drains are either a pipe coupling or flanged type as shown on the assembly drawing.

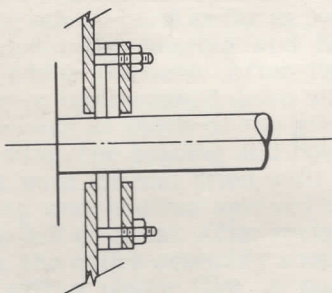
Access Doors are quick opening type for pressures up to 18 - 20" and bolted type at higher pressures.

Side liners and scroll liners are furnished when fan is subject to abrasive wear. The liners are normally shipped in place as a part of the fan housing and further erection procedures later treat liners as a part of the fan housing. Periodic inspection for wear is necessary to prevent wear from eroding through the liner and the fan housing.



1b. HOUSING WITH INLET BOXES

Housing with inlet boxes. Each inlet box is provided with an access door and drain. An asbestos type shaft seal is provided in each inlet box and on many Arrangement 1 fans to minimize gas or air leakage around the shaft.



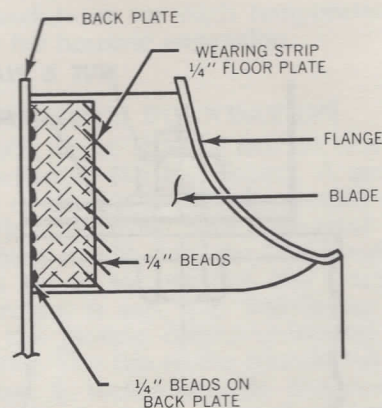
Many fans are furnished with mechanical type air seals, stuffing boxes, air type seals for gas recirculation, and other special seals. Detailed installation instructions are supplied as required since the numerous types are beyond the scope of this manual.

All housing and inlet boxes are completely assembled at the factory. When it is necessary to ship disassembled, each section is as large as possible to speed assembly at the jobsite. Match marking is used for identification and alignment.

2. WHEELS

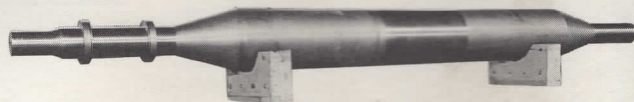
Wheels are always shipped in one piece with all surfaces painted or coated with a rust preventive. All wheels receive a static and a dynamic balance before shipment.

Wear strips are often used on abrasive conditions and are shown in sketches. Regular inspection and periodic maintenance is required. Refer Section V Maintenance — Housing and Wheels for details.



3. SHAFTS

Shafts up to about 8" diameter are hot rolled steel. Larger shafts are forgings normalized and tempered. Shafts are ground to close tolerances and fitted with keyways. Thrust Collars are turned from solid shafting when possible. Some larger fans on gas recirculation or high pressure forced draft service have a shrink fit on the shaft.

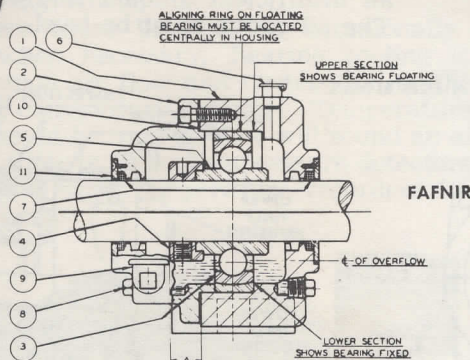
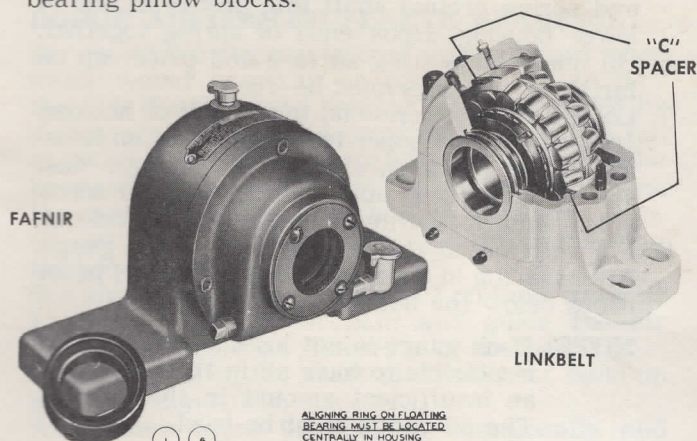


4. BEARINGS

These general instructions cover standard types of anti-friction and sleeve bearings furnished with Buffalo Forge equipment. Detailed information on specific bearings supplied with the fan are found in the shipping envelope or can be obtained from the bearing manufacturer.

1. Bearings should be inspected and thoroughly cleaned if necessary. If a bearing is disassembled, mark its parts in relation to one another to avoid error in reassembly. Do not mix its parts with those of other bearings.
2. Determine type of pillow block and location of fixed bearing.
3. Check all nameplates on fan for special instructions.
4. Mount bearings in position on the shaft in accordance with the particular type of bearing furnished.
5. The shaft should be clean and free from burrs and other irregularities. Be sure bearing is not to be seated on worn flat sections.

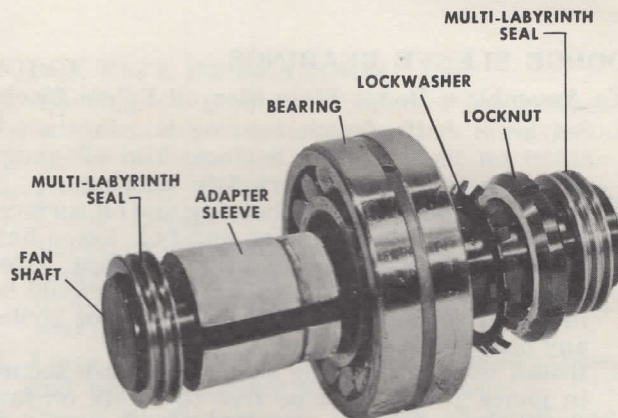
FAFNIR SAOL — fixed and floating type ball bearing pillow blocks.



- Shipped with bearings mounted in the housings but with locking collars separate.
- Remove end cover 2, gasket 10, plates 11 with packings 7. Do not damage gasket and packings.
- Slide pillow block housing 1 with bearing 3 and one plate 11 onto shaft. Position bearing on shaft making sure cam end of inner ring 5 points out.
- In order to position floating bearing in its housing, measure collar projection "A" on fixed unit and duplicate it on floating unit. Since "A" is the same on both pillow blocks, the floating bearing will automatically be positioned in the center of the floating space.
- Bolt pillow blocks securely in position in their mounting surfaces after shimming and aligning. The outside diameter of shaft and housing bore should clear equally all around. Pillow blocks should be mounted so fan wheel and shaft does not strike any part of fan housing.
- Slide locking collar 4 into position against bearing inner ring 5. Turn collar in direction of shaft rotation until it grips shaft and inner ring. Tighten collar with a drift pin in direction of shaft rotation. Tighten set screw in collar.
- Replace gasket 10, end cover 2, packing 7 and plate 11 on end cover. Bolt on end cover.
- Draw up screws holding plates just enough to hold packing rings snugly in place.
- Then fill with oil in top cup 6 until overflow cup 9 is full. Fill only when fan is not running.

LINK-BELT P-LB or **SKF #SAF 225 Series** — fixed and floating type spherical roller bearing pillow blocks.

- The bearing is dipped in a preservative coating at Link Belt and does not have to be removed as it is compatible with grease and oil.
- Set lower half of split housing in position on its mounting surface.



- Apply white lead, thinned with oil, on outside diameter and threads of tapered sleeve and face of locknut (helps in tightening adapter).
- Assemble multi-labyrinth seal ring adapter sleeve, roller bearing, lockwasher, locknut and second seal loosely and position on shaft.
- Hand tighten locknut onto adapter sleeve as tightly as possible.
- Insert feeler gauges between outer ring and the unloaded roller on both sides of bearing until snug fit is obtained.
- Lower shaft with bearing and adapter assemblies into lower half of pillow block housings. Be sure multi-labyrinth seals are aligned with seal grooves. Bolt lower housing to bearing mounting surface after shimming and aligning. Pillow blocks should be mounted so fan wheel and shaft do not strike any part of fan housing, and bearing seals are free to rotate.
- Position floating bearing centrally in lower housing. For a fixed bearing, position bearing for insertion of "C" spacer which is inserted on locknut side (keep bearing flush with opposite side of housing).
- Tighten locknut with a spanner wrench until snug. Place soft metal bar against locknut and strike bar several times with a hammer. Distribute blows around locknut by rotating shaft. These blows drive inner ring farther up on adapter sleeve and release pressure on threads. Use spanner wrench to further tighten locknut. Repeat this procedure until desired amount of clearance has been removed from bearing.

BEARING CLEARANCE REDUCTION FROM READING STEP f.

Link Belt Pillow block series number	SKF-SAF Bearing Number	Reduction of Clearance in Inches	
		Minimum	Maximum
6823 thru 6828	22209 22210	.0010	.0015
6829 thru 6844	22211 22216	.0010	.0020
6845 thru 6868	22217 22224	.0015	.0025
6869 thru 6892	22226 22232	.0020	.0030
6893 thru 68104	22234 22236	.0025	.0035
68105 thru 68116	22238 22240	.0025	.0040
68117 thru 68168	22244 23056	.0030	.0050
6923 thru 6928	22309 22310	.0010	.0015
6929 thru 6944	22311 22316	.0010	.0020
6945 thru 6968	22317 22324	.0015	.0025
6969 thru 6992	22326 22332	.0020	.0030

- Secure locknut by bending lockwasher tang into locknut slot.
- Insert "C" spacer in fixed bearing base on locknut side.
- Lubricate bearings with grease or oil.
- Replace top half of pillow block (cap). Make sure races are not cocked in housing before tightening cap bolts and that bearing seals are free to rotate.

DODGE SLEEVE BEARINGS

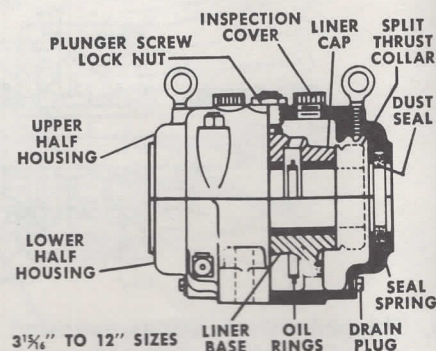
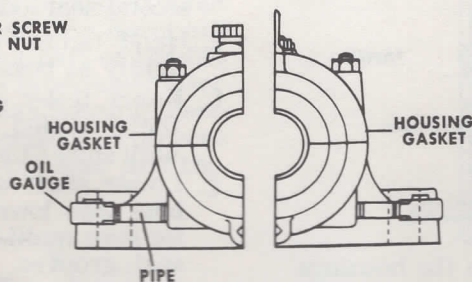
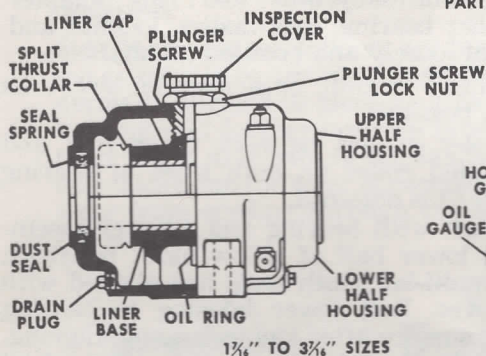
To Assemble a Dodge Plain Sleeveoil Pillow Block:

1. Set lower half of split bearing housing in position on its mounting surface. The oil gauge and pipe should be inserted in housing.
2. Place liner base in lower housing and oil surface.
3. Lower fan shaft onto liner and bolt lower half housing to bearing mounting surface after shimming and aligning. Pillow blocks should be mounted so fan wheel and shaft do not strike any part of fan housing.
4. Install oil rings making sure screws are secure in joints. Rings must be free to rotate on fan shaft. Sizes 1-7/16" to 3-7/16" have one ring. Sizes 3-15/16" to 12" have two rings.
5. Unhook seal spring ends. Thread dust seal

6. Oil liner cap bearing surface and place cap on fan shaft. Oil rings must be free.
7. Loosen plunger screw on upper half of housing (cap) and place upper half of housing on housing studs, being careful not to damage dust seals. Tighten stud nuts and turn plunger screw down snugly. Tighten plunger screw locknut.
8. Fill with oil to top of red circle in oil gauge. After placing in operation be sure oil level never drops below the bottom of the red circle.

NOTE: If oil gauge is not installed correctly it is possible to have oil in the gauge and an insufficient amount in the bearing. The oil gauge must be level.

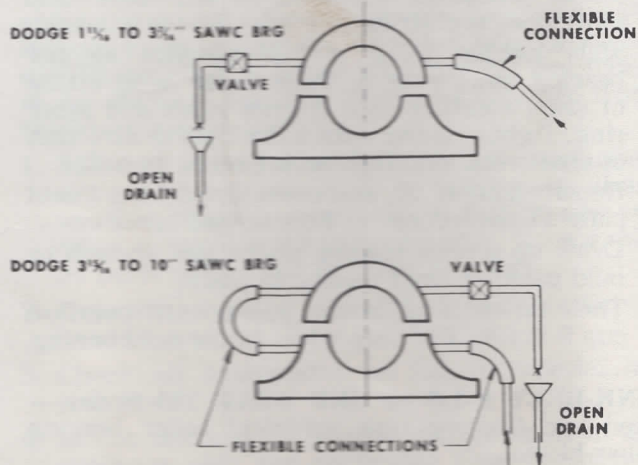
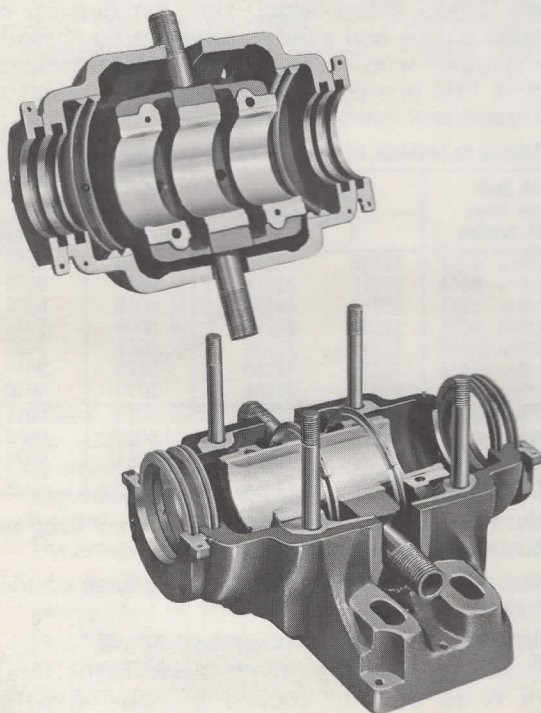
PARTS FOR DODGE PLAIN SLEEVOIL PILLOW BLOCKS



To Assemble a Dodge Water Cooled Sleeveoil Pillow Block: follow the above steps and also install grommet and grommet washer. **Always use Flexible Hose** connections from bearing water pipes to supply and drain pipes. This keeps bearing self-aligning and prevents pipe vibration failure. Buffalo Forge does not supply the flexible hose. A valve should be placed in the piping to regulate water flow. Let water discharge to an open funnel for visual inspection or use flow-spinner in closed system. Water pipes into bearing must be tight,

otherwise, water might leak into bearing causing failure. Use pipe thread compound. Wipe off excess. Regulate flow of water to maximum 100°F drain temperature. Too cold a jacket temperature is likely to cause condensation inside the bearing casing with resultant water in the oil reservoir. When water cooled bearings are subjected to freezing temperatures, compressed air should be available to blow water out of sleeve jackets during shut down.

Before initial starting and after long shut downs add oil through inspection caps and rotate shaft by hand one or two revolutions. Final oil level should not exceed level indicated on the sight glass.

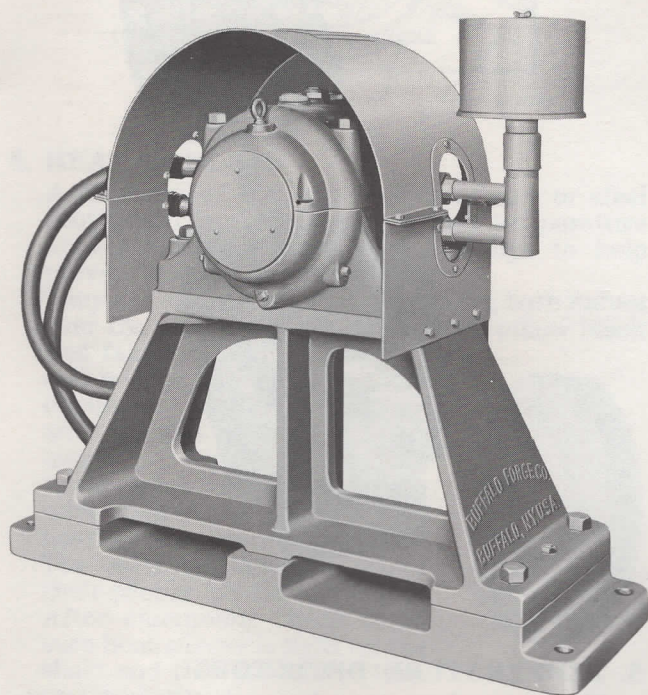


DODGE AIR-COOLED SLEEVE BEARINGS

Air cooled bearing can be used on many fans when water would normally be required. Air to flow through the filter and bearing can be provided by a separate blower or in some cases, from the fan outlet or inlet box. Separate blower drive can be by motor or from the main fan shaft. In all cases, the cooling air is passed through a generous size oil wetted type, outdoor air filter before entering the bronze liner bearing.

Sun shields protect bearings used on Induced Draft Fans from solar heat gain and guide the air handled by the heat slingers over the bearing. Heat slingers on the shaft dissipate heat build-up under the sun shield.

Air Filters must be checked occasionally and cleaned when necessary. Bearing cooling is dependent upon air flow and obstruction of the air filter can cause bearing failure. Temperature detectors should be used as they will sound an alarm when air filter is dirty. Temperature detectors can also be used with temperature recorders to plot variations.



The maximum oil film temperature for an air cooled bearing is about 180°F. Temperature detectors should be set at about 165°F unless otherwise stated on the assembly drawing. Thermometers immersed in bearing oil sump, in lieu of a thermocouple temperature detector, would be about 10°F less, due to the delay from bearing surface temperature to oil temperature.

To assemble:

1. Follow general procedure for water cooled bearing.
2. Connect air filter piping to the bearing and to the source of air cooling. **Note:** Air Cooled bearing air flow is once through and not twice through as water flow.
3. Position split heat slinger around fan shaft at fan housing and fasten halves together. The open side of heat slinger generally is toward the bearing.
4. Install thermal detectors.
5. Assemble Sun Shield.

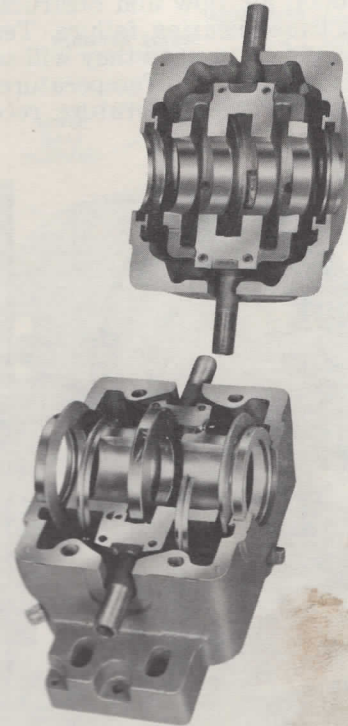
DODGE TYPE RT BEARINGS

1. **Housings Or Liners** can be interchanged as assemblies, but housing caps or liner caps should not be interchanged.
2. **Thoroughly Clean** all parts of pillow block.
3. **Check Levelness** of pedestal. Housing base should be installed on supports so that oil level gauge is in most convenient location. Do not tighten housing base to pedestal. Oil spherical seat in housing base.
4. **Liner Base** should now be set in housing base and bearing surface oiled generously.
5. **Check Shaft** for size, remove all burrs and rough spots. Check collar for burrs and scratches. Use crocus cloth, not emery, to smooth out scratches on the faces. If clamp on thrust collar is used, it should now be installed. Be sure the 2 set screws will clear the shaft. Remove clamp screws and make sure joints are clean. Place both halves in shaft groove, and tighten clamp screws alternately. There should be no offset at the collar faces. Secure both set screws. Oil surface of shaft bearing area. Set shaft in place. The steel collar must be centered with the fixed bearing.
6. **Oil Rings** should now be installed in pillow block; **peen or stake screws** to insure they are secure in joints. Be sure rings are free to rotate on shaft.
7. **Clean Babbitt Faced Thrust Plate**, one set only. **Note plates are matched halves.** Smooth any scratches on the babbitted face with crocus cloth (not emery or sand paper). Oil plate generously. First install thrust plate half with large step at interface. **Note, babbitt must face thrust collar.** Rotate thrust plate half around the shaft into the liner cavity. Place retainer washer (or key) in groove in lower liner at one end of the thrust plate and fasten in place. Rotate thrust plate half until the step in the back face rests against the retainer washer. Place the upper section against the steel collar, again the babbitt must face the collar. Clean and oil second thrust plate and install in same manner. To obtain sufficient clearance in liner cavity for second thrust plate, it might be necessary to position the shaft with thrust collar against the first thrust plate (**CAUTION:** The fixed bearing is not yet fastened in place and can be moved.)
8. **Liner Cap** is not reversible on liner base. Cap and base are aligned and clamped together with tapered dowel sleeves and four hollow head cap screws. Oil the liner cap bearing surface. Carefully locate cap in place, making sure oil rings are free. Install the tapered dowels and cap screws and tighten alternately. If liner cap of fixed bearing will not drop in place, remove it and position thrust plates tightly against thrust collar. Then reinstall liner cap.
9. **Alignment of Pillow Block** should be reasonably accurate as the self-aligning feature in unit is to compensate for normal shaft deflection and possible settling of supports. Check alignment by noting clearance at each end of housing — clearance should be uniform within 1/32". Use shims under base as required. Shaft should rotate freely. Tighten housing base bolts securely.

10. **Cut One O-Ring Open**, wrap around shaft in seal area and cut to fit shaft. Cement the two ends together. Disassemble one seal and place one-half on shaft with flinger facing bearing liner. Locate O-ring in seal groove and rotate seal half around shaft into housing base groove. Install other half of seal and tighten screws. Install second seal in same manner.
11. **Housing Cap** is not reversible on housing base. Loosen plunger screw and locate housing cap on base, using care not to damage dust seals or housing gaskets. Tighten housing bolts; then turn plunger screw down snugly. **THE PLUNGER SCREW MUST BE LOOSE UNTIL HOUSING BOLTS HAVE BEEN TIGHTENED.**
12. **Base Loaded Bearings:** Tighten plunger screw lock nut.
13. **Cap Loaded Bearings:** If shaft must be held down to install cap, tighten plunger screw tightly with the shaft held down. Next mark the position of the plunger screw. Loosen plunger screw one complete turn and loosen shaft hold-down. Next tighten the plunger screw while tightening the shaft hold-down at the same time, until the plunger screw is tight. Do not over tighten shaft hold-down as this can misalign liner. Remove shaft hold-down and tighten plunger screw locknut.
14. **Install Grommet** and grommet plate over coolant pipes. Install bushing and locknuts on pipes and snug up nuts, not tight. Make pipe connections required for coolant, making sure that lengths of all pipes are correct and unions are well aligned. Careless fitting will result in serious preloading of bearings. To avoid any possibility of preloading bearings, flexible pipe connections are recommended. A valve should be placed ahead of each inlet and a sight drain should be used at each outlet if possible when liquid coolant is used. The recommended method of connection for **liquid coolants** is to connect the inlet to the one pipe and the outlet to the other pipe on the same side of the bearing. A return is then used to connect the two pipes on the other side of the bearing. Adjust coolant flow to suit conditions. Under normal conditions very little coolant is required. For **AIR COOLING** connect the inlet to both coolant pipes on one side of the bearing and the outlet to the two pipes on the other side.
15. **Oil Level Gauge** may be located at any distance from pillow block by use of a coupling and a pipe of desired length. This extended pipe must be supported so that it remains straight and level with no offsets up or down (use a spirit level — do not guess). Use a pipe sealer on all connections.
16. **Flush Bearing Liner Bore and Housing Thoroughly.** Remove all pipe plugs and install with pipe sealer. Tighten securely.
17. **Lubrication and Operation:** Fill with oil to top of red circle in oil gauge. After placing in operation, remove inspection covers and check oil rings to see that they are rotating freely and bringing up oil. Operation should be observed frequently during the first few days. If noise develops, check alignment of housing, seal run-out, plunger screw, and all operating parts. Check all points and tighten screws and nuts

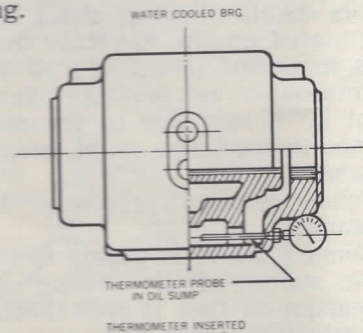
after several days operation. Drain, flush and refill with oil after 2 to 3 weeks of operation and approximately every three months thereafter for 24 hours a day service or every six months for 8 hours a day service with a periodic visual check between changes for oil contamination. Maintain oil level above bottom of red circle at all times.

18. **CAUTION:** IN REMOVING UPPER LINER HALF, BE SURE THE THRUST PLATES REMAIN IN PLACE NEXT TO THE THRUST COLLAR. IF A PLATE HALF REMAINS IN THE UPPER LINER, IT CAN DROP FROM THE LINER AND CAUSE INJURY.



5. TEMPERATURE DETECTORS

Sleeve bearings may be equipped with a dial thermometer emersed in the oil sump. It is screwed into the tapped drain hole of the bearing housing.

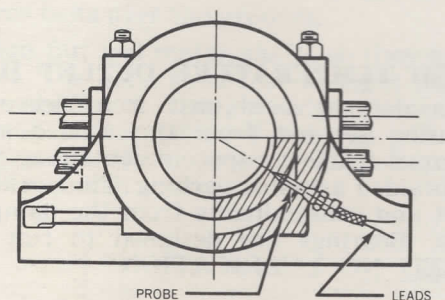


Thermocouples or electrical resistance temperature detectors can be used. A Thomas A. Edison Type 166NC (or equal) electrical resistance temperature detector is often used. Where thermocouples are required, a Leeds & Northrup 8790 Series or Minneapolis Honeywell probe

can be used — either one covering copper constantan, iron constantan or chromelalumel. Both types are mounted by inserting the end of the probe thru the tapped hole in the pillow block into the liner hole. If the probe does not fit DO NOT FORCE IT since the bearing may have been assembled with liner drilling on the wrong side.

The probe leads are wired to the dial indicator or alarm at the jobsite. The electrical resistance detector must have an EMF input to cause a change in metering equipment. The thermocouple by nature of the bi-metallic strip, causes its' own EMF to activate the metering instrument.

THERMOCOUPLE MOUNTED
IN BEARING

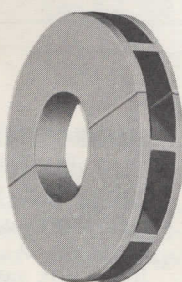


6. HEAT SLINGERS

A heat slinger is a split cast aluminum or steel centrifugal fan wheel used on high temperature applications and air cooled bearings to help prevent heat build-up.

They are easily assembled by placing both halves over the shaft between the fan side pillow block and fan housing or shaft seal and bolting together. For fans equipped with oil lubricated anti friction or sleeve bearings, the inlet should be towards the fan housing. The inlet should be towards the bearing if grease lubricated. The assembly drawing shows their proper location.

After assembling check to be sure heat slinger is tight on the shaft and that it will not turn on the shaft.



7. VARIABLE INLET VANES — VIV's

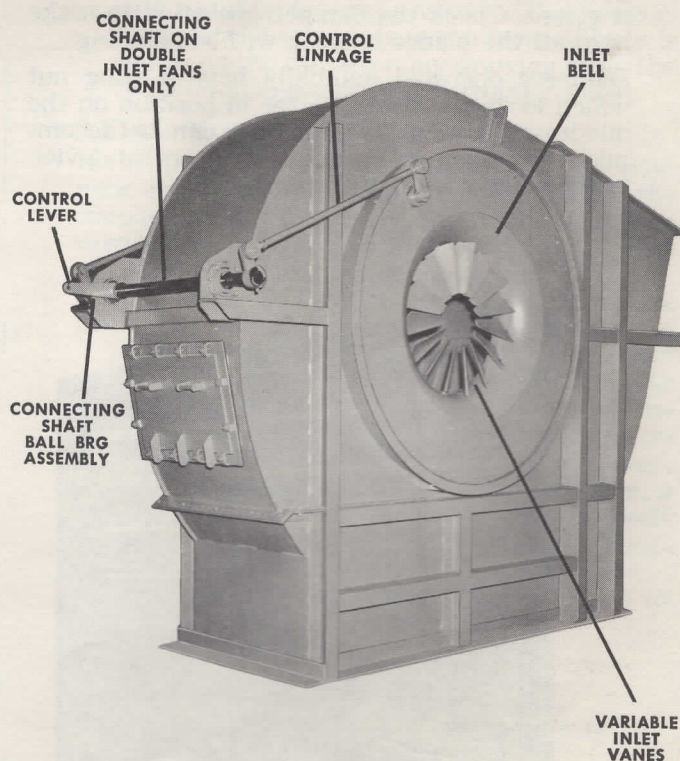
Variable inlet vanes regulate fan capacity through moveable vanes in the fan inlet. A linkage joins all vanes together causing them to operate in unison when moving the control lever. The VIV is completely assembled in the inlet bell and adjusted for proper operation at the factory. When the VIV is installed at the job site, it is ready for operation. Make sure vanes will spin air or gas in the same direction as wheel rotates. Connect linkage from VIV crank arms to connection shaft assembly on double inlet fans according to the fan drawing. No further servicing should be required.

Operate the control lever to make certain the vanes move easily from open to closed positions. This should be done BEFORE any inlet ductwork or inlet boxes are attached to the fan which will make the VIV inaccessible.

VIV's operated manually have a wing nut which locks the control level in position on the quadrant. Automatic operation is accomplished by connecting a suitable control device to the VIV control lever. Control linkage should be adjusted so that operator applies slight pressure to insure complete closure. Be sure there is sufficient operator and linkage travel to assure vanes are fully open. Double inlet fans include a connection shaft for operation of both inlets with one lever.

On some fans, in order to limit the horsepower, a stop is used to control the maximum open position. Do not remove this stop.

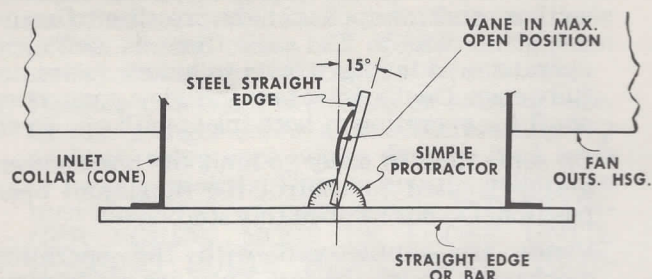
Vaness are cantilevered with the operating mechanism inside the fan. They are easily serviced by removing the inlet bell which includes the VIV assembly. Each vane shaft is supported by two oilite bushings separated by a steel sleeve, or by two prelubricated ball bearings.



MEASURING MAX. VIV OPEN POSITION

1. Open VIV as far as possible.
2. Lay straight edge or long bar across inlet.
3. At right angles to this bar, extend another straight edge into the vanes and lay it across one vane's two edges. Any vane in the inlet can be used.
4. Measure angle between edge of straight edge and fan shaft center line.
5. Sketch shows a counter-clockwise fan. For a clockwise rotating fan the 15° will be to the left of the center line instead of the right.

6. The maximum open position of the vanes must be 75° from a closed position. Stops are placed on the vanes at the factory to prevent more than a 75° open position.



8. DAMPERS

Dampers are furnished in separate channel section either structural or fabricated. It is best to close the damper when installing to prevent damage to the damper blades.

The damper blades and linkages are pre-set to give a tight fit between blades when the damper is closed. Check the damper operation to make sure all the blades operate without binding.

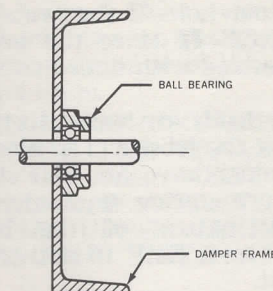
Dampers operated manually have a wing nut which locks the control lever in position on the quadrant. Automatic operation can be accomplished by connecting a suitable control device to the control lever of the damper.



LOW TEMPERATURE OUTLET DAMPER

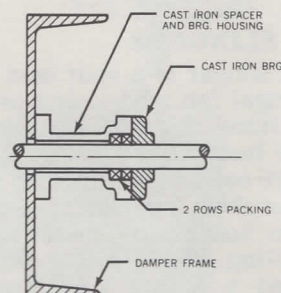
This damper design has a welded structural steel channel frame with the blade shafts mounted in FAFNIR permanently lubricated, ball bearings. If bearings are permanently lubricated with a silicone grease, higher temperature usage is possible.

If the bearings have lubrication fitting — available on request — be sure to lubricate at least once a year.



HIGH TEMPERATURE OUTLET DAMPER

This damper uses cast iron sleeve bearing housing set out from the welded structural channel frame by spacers containing two rings of braided asbestos packing. The packing keeps dust and contaminants from the damper bearings. Bearings are designed to run dry and **NEED NO LUBRICATION.**

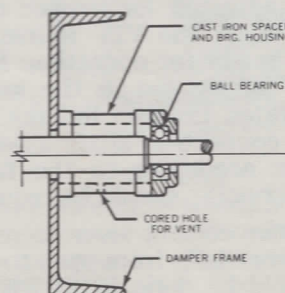


HIGH TEMPERATURE INLET BOX DAMPER

This damper uses FAFNIR, permanently lubricated, ball bearings in a cast iron housing set out from welded structural channel frame by spacers. A vent hole in the spacers prevents inlet box suction from pulling air through the bearings.

The blades will open or close in the same direction — louvre type.

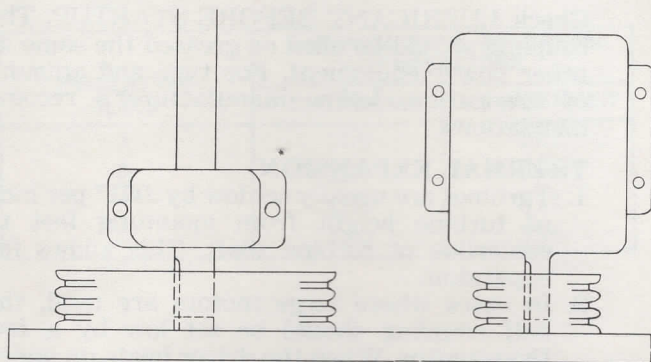
On double inlet fans, inlet box dampers are controlled from a common shaft usually arranged for automatic control. Mount dampers in place on inlet boxes and position control shaft to housing according to the assembly drawing.



9. V-BELT DRIVES

V-belt drive assembly

1. Clean motor and fan shafts. Be sure they are free from corrosion. Clean bore of sheaves and coat with white lead or heavy oil for ease of shaft entry. Remove oil, grease, rust or burrs from sheaves.
2. Place fan sheave on fan shaft and motor sheave on its shaft. **DO NOT POUND SHEAVES ON** as this may damage bearings. Tighten sheaves in place. Be sure sheave is as near bearing as possible without sheave or belts hitting bearing mounting.
3. Move motor on slide base so belts can be placed in grooves of both sheaves without forcing. Do not roll belts or use a tool to force belts over the grooves.
4. Align fan and motor shafts so they are parallel. The belts should be at right angles to the shafts. A straight edge or taut cord placed across faces of sheaves will aid in alignment. If not properly aligned excessive belt wear can occur.



5. Before putting belts on be sure to check for correct direction of motor rotation.
6. Tighten belts by sliding motor in its base. Correct tension given the best drive efficiency. Excessive tension causes undue bearing pressure. Recheck alignment.
7. Start the fan and run it at full speed. Adjust belt tension until only a slight bow appears on the slack side of the belts. If slippage occurs, a squeal will be heard at start-up. Eliminate this squeal by tightening up the belts.
8. Give belts a few days running time to become seated in sheave grooves — then readjust belt tension.

If the shafts become scratched or marked, carefully remove sharp edges and high spots such as burrs with fine emery cloth or a honing stone. Avoid getting emery dust in the bearings.

Do not apply any belt dressing unless it is recommended by the drive manufacturer.

V-belts are designed for frictional contact between the grooves and sides of the belts. Dressing will reduce this friction.

Belt tension on an adjustable pitch drive is obtained by moving the motor — **not by changing the pitch diameter of the adjustable sheave.**

10. FLEXIBLE COUPLINGS

A fan shipped assembled with coupling mounted has the coupling aligned. Handling during shipment could throw it out of alignment. Check coupling alignment before starting fan. After checking coupling alignment before bolting coupling together it is best to start motor and assure correct direction of rotation.

MOUNTING

If either coupling half has not been previously mounted on its shaft, the following procedure can be used: (refer to specific instructions found in shipping envelope):

1. Place coupling covers or sleeves over shaft ends.
2. Insert keys.
3. Install hubs on shaft with faces flush with shaft ends. If they do not go on by light tapping with a soft lead hammer, heat in water or oil and position on shafts.
4. Set motor at its magnetic center, if marked on shaft; otherwise find it (see **AXIAL MOVEMENT** below). With motor rotor on its magnetic center, locate motor on its base with coupling faces at proper axial clearance. Necessary clearance between faces of hubs is shown on the fan assembly drawing or on the coupling manufacturer's instruction sheet.

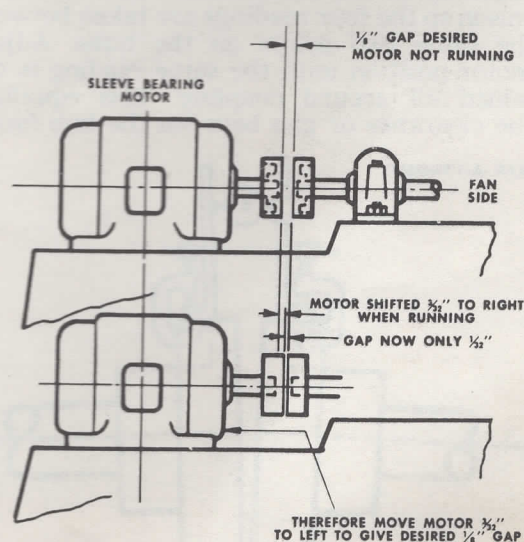
AXIAL MOVEMENT

If the driver is a sleeve bearing motor, its magnetic center must be found before aligning the coupling halves to prevent the motor half from moving up against fan half coupling. To find the axial movement of the motor shaft:

1. Run motor and notice how far shaft moves.
2. Or, push the shaft as far as it will go into the motor housing and mark a line on the shaft at the housing. Then pull the shaft out as far as it will go and scribe a line. Half the distance between the two scribed marks locates the sleeve bearing motor's magnetic center.

If motor axial movement becomes a problem, a limited end float coupling can be used to limit this movement and keep motor near its magnetic center.

A ball bearing motor has its thrust bearing to prevent movement.



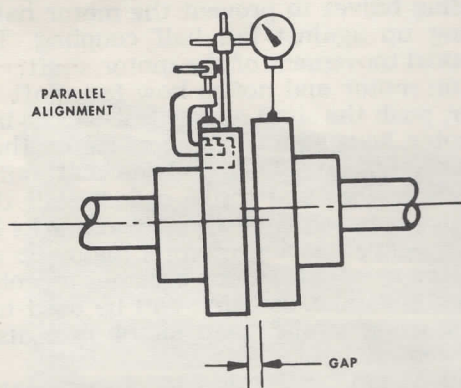
COUPLING ALIGNMENT —

The flexible coupling must be carefully aligned as it is not designed to compensate for the shafts not being exactly correct one to the other.

Coupling alignment can be done by two methods. (1) With a dial indicator or (2) with a steel straight edge and feeler gage. The dial indicator method is preferred since increased accuracy is obtained and the quantitative readings make it possible to determine exactly what shim adjustments are required. Because the position of the fan half of the coupling is determined when the fan shaft and bearings are aligned, any necessary adjustment will usually have to be made by moving the driver. When in correct alignment the faces of the coupling should be parallel and hubs concentric.

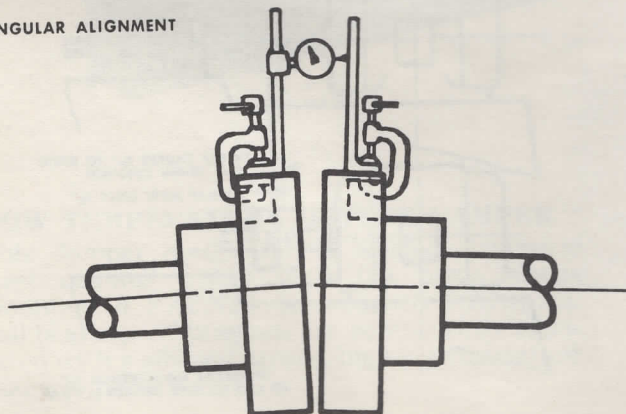
Dial Indicator Method

1. Parallel alignment. Fasten indicator bracket on one hub with dial button contacting alignment surface of opposite hub. Rotate shaft on which indicator is attached and take readings at four points: top, each side and bottom. Difference between the two side radial readings indicates motor must be shifted sideways. Difference between top and bottom readings indicates motor must be raised or lowered by adding or removing the same thickness of shims under all four feet. Amount of correction in each case is one half the difference between the two readings.



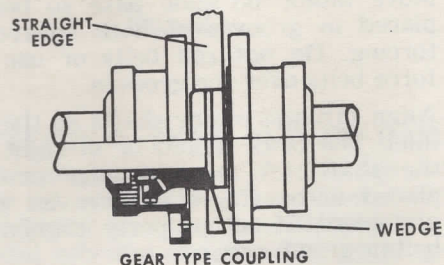
2. Angular alignment. Fasten the indicator brackets on the hubs. Rotate both shafts in unison so the four readings are taken between the same two points on the hubs. Adjust motor position until the same reading is obtained all around coupling. This equalizes the clearance or gap between the hub faces.

ANGULAR ALIGNMENT



Straight Edge and Feeler Gage Method.

1. Parallel alignment. Place a straight edge across the coupling hubs. Raise or lower the motor by shimming until the straight edge lies true at top and bottom positions on the hubs. Placing the straight edge on each side of the hubs will align them in the horizontal position. Shift the motor sideways to adjust horizontally.
2. Angular alignment. The clearance between the hub faces can be equalized at four points with a steel wedge or feeler gage.

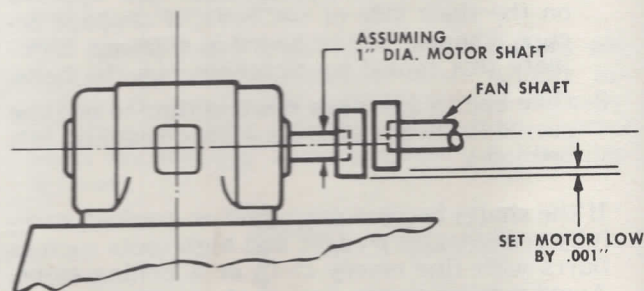


COUPLING LUBRICATION

Check LUBRICANT BEFORE STARTUP. The coupling should be oiled or greased the same as other power equipment. For type and amount of lubrication, follow manufacturer's recommendations.

THERMAL EXPANSION

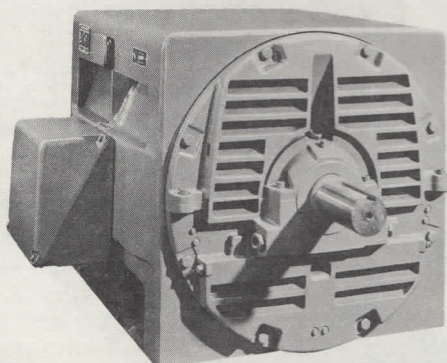
1. Turbines are usually set low by .001" per inch of turbine height from mounting feet to centerline of turbine shaft. This allows for expansion.
2. In cases where large motors are used, the half coupling should be set low by a few thousandths. When the driver heats up under operating conditions it will expand and bring the coupling in line. A reasonable figure must be assumed at the initial line up. A rule of thumb is .001" for each inch of motor shaft diameter and no more than 4 thousandths.
1" shaft dia. — set motor low by .001"
2" shaft dia. — set motor low by .002"
3. After fan and driver have been operating and thermal expansion is complete, recheck coupling alignment and correct if necessary.



11. MOTORS

After motor has been mounted, aligned and bolted down, wire to power supply through a disconnect switch, short-circuit protection and suitable magnetic starter with overload protection. ALL MOTORS should be connected as shown on the nameplate. Install all wiring and fusing in accordance with the National Electric Code and local requirements.

Normal operation of motors results in temperature rises according to motor insulation. The total motor operating temperature includes ambient temperature plus motor temperature rise. The motor rise includes nameplate temperature rise, service factor allowance and hot-spot allowance.



INSULATION CLASS	MAXIMUM TOTAL OPERATING TEMPERATURE	
	° CENTIGRADE	° FAHRENHEIT
A	105	221
B	130	266
F	155	311
H	180	356

Various motor troubles can be caused by:

1. low or high voltage.
2. overload — high temperature — drawing too much current — improper ventilation — excessive ambient temperatures — or dirty operating conditions.
3. armature unbalance — vibration and noise.
4. worn bearings — armature rubs against stator.
5. too much or not enough lubricant in bearings.
6. commutator brushes on d-c motor worn or not seated under proper tension.
7. loose hold down bolts — vibration and noise.
8. dirt in windings — high temperature.
9. low insulation resistance due to moisture — check resistance with a megohm meter ("Megger") or similar instrument employing a 500 volt d-c potential. Resistance should read at least 1 megohm. If it is less, remove motor from service, clean and dry windings. A high grade insulation varnish should be applied to the windings before putting back in service.
10. a bent shaft can cause unbalance in fan and bearing failure or overheating.

For large motors obtain the time required between successive starts from the motor manufacturer. All starters should be properly marked. NOTE: After motor is mounted on the foundation and coupling aligned, before bolting coupling together, it is best to bump the motor without load to ascertain correct motor rotation.

SECTION III

ERECTION OF HEAVY DUTY FANS

1. INTRODUCTION

Most Buffalo Forge Heavy Duty Fan Equipment is shipped disassembled. For fans shipped assembled, the basic steps are worth reviewing. The following fundamental procedure is for a double inlet fan with inlet boxes and sleeve bearings on pedestals and soleplates; while single inlet fans, double inlet fans without inlet boxes, roller bearings instead of sleeve bearings, etc., will differ somewhat.

NOTE: IN EVERY ASPECT OF THIS SECTION ON THE JOB SAFETY IS PARAMOUNT.

2. IDENTIFICATION OF PARTS

Before starting erection of fans **identify** all fan parts using the assembly drawing and matchmarks as the reference. If more than one fan is involved separate parts to prevent confusion during assembly. All wheels have rotational arrows painted on them. All wheels and shafts are fitted at the factory.

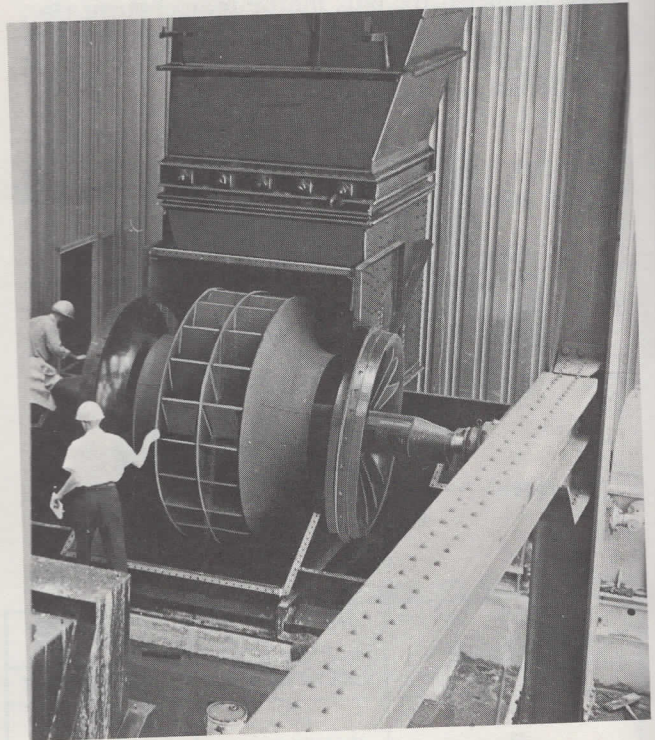
On DIDW fans the wheel shaft and key are stamped "1" or "2" so keys are placed on the correct side. Keys have a special fit and should be carefully identified by matchmarks.

3. CHECK FOUNDATION

Determine that foundation bolt location agrees with the assembly drawing and fan. For high temperature operation, provide for fan expansion in foundation. Determine correct center line by a survey or transit. The center line is then used as a reference for all of the subsequent erection work. Include the driver and determine the shaft center line height from the concrete or some other reference point in the foundation or some fixed point close by. Refer Foundation, Section I.

4. SET BOTTOM OF FAN HOUSING

Lift housing into place. If housing is split, move lower half only into position. Do not lift the housing with a fork lift or car loader. The housing should be carried sufficiently high to clear the foundation bolts and should be lowered onto blocks so the base angles clear the foundation bolts. The base angle holes should then be aligned carefully with the foundation blocks and lower the housing carefully over the foundation bolts so as not to damage the threads. Put temporary shims under the housing of approximate thickness of grout. Shims (about 4" wide) should be flat and flush with edges of the base angles. The weight of the unit should be borne by at least one shim on each side of every foundation bolt. Attach the inlet boxes to the housing. These may be bolted to the housing through a bar iron welded on edge on the housing or fastened to locating clips on the housing side with a few bolts and then seal welded to the fan housing. If a special inlet box support leg is required, attach but do not pull down tight to its foundation at this time. Secure fastening is done only during the final alignment procedure.



5. SET BEARING BASE

Put the pedestals in place maintaining approximately correct elevation of the center of the bearing. The held bearing should be set level. Leveling should be accomplished by flat shims under the soleplates. Pedestals, tops of soleplates and bearings are machined to exact tolerances and therefore will set in position at the correct level if the foundation is perfectly correct per the design drawings. Occasionally a foundation may vary slightly from the fan base or may settle and, for future use, the fan erector can help himself by adding shims of approximately 1/16" between the pedestal and the bearing. Shimming upward is fairly simple but dropping the level of the bearing is virtually impossible if an error is found or a change in center height is needed later. The shims should be of adequate area to carry the weight of the parts above it and may be slotted to clear the bearing bolts for easy installation or removal.

6. PREPARE WHEEL AND SHAFT

Remove the shaft from the box with a nylon or rope sling. **Note: Do not lift by bearing journal surfaces.** The shaft rests in saddles in the shipping box and the slings may be placed underneath the shaft easily while the shaft is still in the box. Remove the shaft preservative with solvent. After preservative is removed, coat the journal area with clean oil with a clean applicator. **NOTE: Do not touch the cleaned journal surface with the bare hand since perspiration can cause discoloration and pitting.**

On double width wheels clean the space between the hubs carefully and remove all foreign objects which can fall onto the shaft as the wheel is turned. Clean the bore of the wheel hubs with suitable solvent and lubricate for entrance of the shaft.

Turn set screws in and be sure they are long enough to hold wheel to shaft. Now turn the set screws out sufficiently so the shaft clears. If three set screw holes appear in the hub use only two, one over the key and one leading the key in the direction of rotation. Lift the shaft supported securely by two rope slings, one near the middle to support the weight and one to balance the shaft.

Be sure the rotation arrow on the housing corresponds to the rotation arrow on the wheel and the shaft thrust collars are on the drive end. For proper wheel installation, compare blade shapes with wheel rotation. See Section I, Article 5. In the case of a dual drive the held end bearing should be determined before the shaft is placed in the wheel. Place the shaft into the bore of the hub. After the shaft is part way into the wheel, set both ends of the shaft on supports, and turn wheel as required to align keyway. It is suggested the shaft keyway be up for aligning. After aligned push wheel to correct position.

Select the key marked "1" or "2" in double wheel and, after coating the key with white lead and oil, tap into keyway as marked. It is suggested that the gibhead key NOT be pushed flush with the hub. Leave about 1/2" clearance for later removal.

Tighten the set screws in the wheel only after wheel and shaft are in place on bearing and the inlet bell adjustment has been made.

7. PUT INLET BELLS OR VIV'S ON SHAFT

Place inlet bells or fixed or variable vanes over shaft, being sure that the rotation arrow or designating mark on the inlet part corresponds to the corresponding marking of the housing and wheel. Take care to prevent damage to the journal section of the shaft.

8. PREPARE BEARINGS

Remove the caps from the bearings and carefully clean the bearing surfaces with solvent. Apply a coating of clean oil with a clean applicator (some prefer to actually pour oil over the surface). Cover immediately with clean cloth to keep out dirt, rust particles, weld spatter or anything else which might fall from above. Inspect and clean the oil rings, then put shaft seals and oil rings in the same place so they will not be damaged before they are installed. Refer Section II Bearings.

IMPORTANT NOTE: If thermocouples are being used, be sure the bearing housing drilling is in the proper location and the liner matches.

9. SET WHEEL AND SHAFT IN BEARINGS

Now the wheel and shaft may be placed in the bearings. Extreme caution should be exercised in placing the thrust collars over the held liner. Mishandling may severely damage the

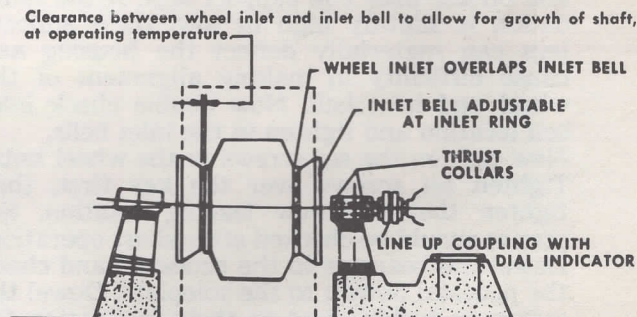
bearing metal beyond repair. In the case of large bearings it is quite difficult to lower the heavy rotor into the bearings without marring the bearing metal since large rotors are very bulky to move with only a few mils tolerance in their final position.

It is suggested to lower the rotor to just above the bearings then lift the held bearing liner up around the shaft. The bearing liner is much lighter than the rotor and is easier to guide into place between the thrust collars. The bearing liner may then be fastened to the shaft so the liner can be lowered into the bearing housing. In the case of restricted height, some erectors consider it a better practice to assemble both bearings complete to the shaft before setting the bearings on the pedestals. If done in this manner the free end bearing **MUST** be attached securely to the shaft so it does not slide off. Set rotor in bearings.

Arrangement 1 and 8 fans have an overhung wheel which causes the outboard bearing to be top loaded. The outboard shaft extension must be pulled down with a come along to seat the shaft tightly in the bearing. Tightening the plunger screw on a sleeve bearing should not be attempted until this has been done. The coupling alignment should follow.

10. ALIGN FLEXIBLE COUPLING

Now level the held bearing using machinist level. Due to the deflection in the shaft, the outboard bearing is set at a slight angle. The shaft extension will then be level as will the driver, and the ends of their respective shafts will be vertical. Refer to following sketch.



Shaft Deflection is exaggerated to show inboard bearing, pedestal and drive level. Outboard bearing and pedestal set at angle to line up with shaft deflection.

Shaft deflection is slight and amounts to .003" to .010" per foot of shaft measured between centers of bearing. Shaft deflection is same whether fan is idle or operating.

If there is a dual drive, the driver which will operate for the greater length of time is set perfectly level on the held bearing end of the shaft and the driver which will operate for shorter durations is placed on the free bearing end of the shaft.

Refer Flexible Couplings, Section II. Determine direction of motor rotation before bolting coupling.

Complete the assembly of the bearing as described in Sleeve Bearings, Section II.

11. COMPLETE ERECTION OF HOUSING

Attach the split section for rotor removal using the suitable gasket material shipped with the fan. Use moderate drifting to align bolt holes, if necessary. There is no gasket material to be used at the intersection of the inlet boxes and housing or at inlet cones. Gasket material should be used at the split section in the housing only. If a special housing section is welded, it is located to the matching sections by locating clips with a few bolts for purposes of locating the respective parts for seal welding. The inlet boxes may also be bolted or welded to the housing. If welded, they may already be in place as shipped from the factory or, if separate due to shipping limitations, positioning clips are in place of the fan housing side to orient the box before seal welding is completed.

12. CORRECT INLET BELL OR VIV LOCATION AND TIGHTEN ALL BOLTS

Attach inlet bells to the housing from the outside of the housing, but do not tighten the bolts completely. Adjust the wheels and inlet bells for correct alignment with one another. If induced draft service, the wheels should overlap the inlet bell on the drive side allowing clearance on the opposite side for the growth of the shaft at operating temperatures. The shaft grows .008" per foot per 100° difference in temperature. (Example, at 570° and 5'6" of shaft is $.008" \times 5 \times 5\frac{1}{2} = .22"$). The fan assembly drawing shows these clearances. If forced draft service, consult the drawing for the correct lap on each side. The wheel may be moved slightly on the shaft to facilitate alignment with the inlet bells.*

Pull down the foundation bolts on the housing and on the inlet box support legs. If the foundation is slightly high or low, these support legs can materially deflect the housing and cause difficulty in making alignment of the wheel and inlet bell. Now double check inlet bell location and tighten in the inlet bells.

Now tighten the set screws in the wheel hubs. Tighten set screws over the key first, then tighten the set screw leading rotation. Set screws should be checked after short operation. Dowel the bearings to the pedestals and check the pedestal dowels to the soleplate. Dowel the motor or turbine feet to their foundation for realignment purposes.

13. INSTALL SHAFT SEALS on the inlet boxes.

Refer Page 6 for sketch of shaft seal. Before the plates are tightened, asbestos is free to move and take up slight misalignment of inlet boxes and/or shaft. Shaft seal should be concentric with the shaft. Asbestos should be set slightly low to compensate for housing growth under temperature.

Inner retainer plate should be checked on the free end if any vibration develops under temperature since inner steel plate may be rubbing on the shaft due to shaft growth.

14. GROUT UNDER THE SHIMMED FAN HOUSING AND BEARING SOLEPLATES

Grout composition will vary, but in the absence of a specified composition one part cement to

one part sand may be used.

It is suggested that the alignment of the flexible coupling be rechecked after approximately seven to ten days. The motor foundation or the entire foundation may settle or change in alignment slightly and the motor must then be realigned. Allow for housing expansion on high temperature fans when grouting foundation.

15. INSTALL DAMPERS - CONNECT DUCTWORK

Next attach the outlet dampers or the inlet box dampers using suitable gasket material. The use of drift pins for this purpose should be limited to positioning only and not for forcing the damper into place. If the housing or inlet boxes or dampers have not been distorted due to erection procedures, these parts will fit since they have been completely fitted and assembled at the factory.

If an inlet box damper control shaft is used, it is shipped in a separate box with dampers mounted and with levers pinned in place on shafts. The entire jack shaft unit may be mounted and connected to the individual dampers. Consult the fan assembly drawing for positioning.

16. VIV CONTROL MECHANISM

If the fan has variable inlet vanes, the control mechanism on the single fan would be on the fan side next to the inlet or, if specified, may be connected through a jack shaft and bearings mounted on the fan housing. In the case of double width fans the linkage from the vanes on each side is connected to the jack shaft which is mounted on the fan housing.

On double width fans, if the jack shaft levers connecting each set of vanes do not line up with the connecting rods to its mechanism, the lever has been moved to protect it during shipment. Remove the pin from the jack shaft, slide levers back into position, carefully lining up pin holes in levers in the shaft and replace the pin. Attach the connecting rods from individual mechanisms.

17. ARRANGEMENT 1.

On many Arrangement 1 fans the wheel is mounted and removed through the fan inlet or in the case of some high pressure blowers the inlet side of the housing is removable. The erection is as described in the foregoing paragraphs with minor changes as applicable to this arrangement.

18. EXPANSION JOINTS AND DUCTWORK

If fan being erected is for high temperatures, expansion joints are absolutely necessary at the fan connections. They must allow expansion of the fan housing and connecting ductwork without distorting each other in the process. Be sure to remove any shipping braces from the expansion joints before attempting to operate fan and provide for fan expansion

*On single inlet single width fans align the wheel to the inlet bell allowing the gap between the backplate and the housing to take up the tolerance.

in setting the housing foundation.

Neither the duct connections nor the fan housings nor the inlet boxes should be forced with drift pins, comalongs or any other means to make the duct connections.

19. INSULATION

When specified, insulation clips may be furnished on fan housings and inlet boxes on 12" or 18" centers and the bracing drilled for insulation wires. Several types may be furnished such as KSM or Nelson stud with hole in the end for attaching insulation. Wire is placed through the insulation clip, (the normal length of wire is about 24") and bent together. Holes are punched in the block type insulation and

the insulation is put over the extended wires and the ends of the wires bent to hold the insulation against the fan.

Provision should be made for future disassembly without pulling insulation off at housing splits.

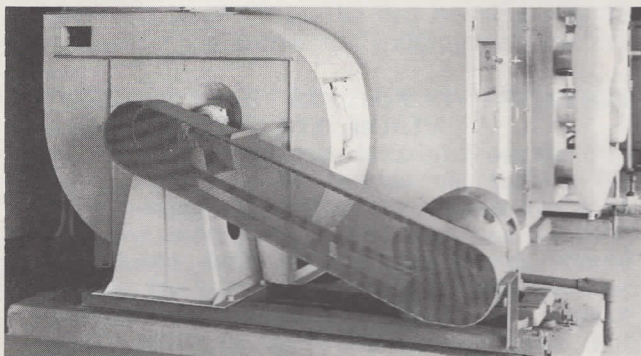
When specified, a raised and insulated access door may be furnished so that its surface is about even with the surface of the insulation.

SECTION IV OPERATION

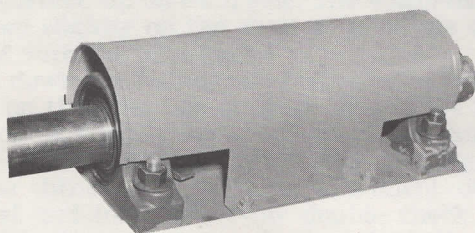
1. SAFETY

Most plants have very good safety checklists and to these companies the following may be routine, however, Buffalo Forge Engineers believe safety cannot be overemphasized.

1. Flexible Coupling guards are imperative. Do not start fan without guard in place.
2. V-Belt Drive Guard should completely encase the sheaves and drives. Do not start fan without guard in place.



3. Shaft Guards are recommended for Arrangement 1 fans to extend from one bearing to another.



4. Inlet screens on all open inlet fans. Outlet screens on exhaustor fans without ductwork on outlet of fan. Screens over inlet boxes if there is no ductwork on inlet box.
5. Guards on accessories with moving parts such as auxiliary blower for air cooled bearings, tachometer generator, or turning gears on high temperature fans.
6. When structural bracing extends from fan housing, Safety Devices may be indicated.
7. Before start-up, make sure all parts are tight; all tools and materials removed and that every one stands clear.
8. Controller Mechanism on VIV's and Dampers normally do not have safety devices but often have special painting.
9. On large fans, properly designed catwalks are a necessity.
10. Periodic inspection of fan wheel and housing liners is a must, since corrosive or abrasive wear can cause serious fan failure.
11. Some companies insert a scaffold board through the fan wheel from the access door when workmen are to be inside the fan. In any case be sure fan cannot be started while workmen are working on a fan.

2. START UP

Carefully review all work steps at this time. All bolts should now be tight. Access Doors should now be closed. Coupling Guards or V-Belt Guards and other safety devices should be in place.

Be sure wheel and inlet bell do not strike and will operate without any foreseeable difficulty.

Check bearings very carefully. Oil should be at proper level. Coolant should be flowing without leaks.

Check out Dampers and VIV's so they operate freely and blades will close tightly. Close all dampers and VIV's for start-up to reduce power consumption. This is very important for high temperature fans being started at room temperature. Open dampers when fan is up to speed being careful not to overload the driver. When dampers are closed rough operation may be a possibility.

At start-up be sure wheel rotation is correct. Refer Section I for data.

Fan should now be ready to bring up to operating speed. Carefully watch for the unusual such as excessive vibration, noises, bearing or motor overheating, etc. If trouble is encountered shut fan down and correct problem. Check bearing to be sure oil rings are rotating.

After a run in period of generally 8 hours, alignment should be rechecked, bearings inspected, perhaps oil flushed out and replaced, etc. Bearings may now be doweled to the pedestal, if all seems correct. This doweling will allow for ease of disassembly and realignment.

3. FAN BALANCING

Fan wheels are balanced statically and dynamically at the factory and, if undamaged, should require no further balancing. However, every fan must be given a balance check at start up. In most cases this is routine but adjustment and alignment can cause minor difficulties.

Before any attempt is made at balancing, check other causes of vibration or unbalance as listed in the FAN TROUBLES/CORRECTION section. Portable instruments are available that will indicate vibration displacement in mils (1 mil = 0.001 inches). The following table can be used as a guide to determine when a fan is operating with too much vibration:

FAN SPEED RPM	SMOOTH	FAIR	ROUGH	VERY ROUGH
600	2 mils	4 mils	8 mils	15-20 mils
900	1.5	2.75	6	8-10
1200	1.0	2	4.5	6-8
1900	0.75	1.5	3.5	5-7

The fan can also be balanced by a trial-and-error method. This is done by chalking the fan shaft. Chalk the shaft as follows:

1. Bring the fan up to operating speed. If the fan and motor and bearing base are on vibration isolators, place blocks under the fan to make the isolators unoperative. The fan must be rigid while checking balance.
2. Clean the shaft by holding piece of emery cloth against rotating shaft at the housing on both sides of the fan.

3. Hold a sharpened piece of chalk or soapstone so the point just touches the rotating shaft. The chalk will scribe a line on the shaft, the length of line indicating amount of unbalance. 3 or 4 lines should be made so an average can be taken. The chalk must be held firmly, so it will be touched only by the high spot, not allowed to "ride" the shaft. When there is unbalance, the shaft will be forced to deflect outward by the unbalanced weight, producing the highspot.
 4. Stop the fan.
 5. Turn wheel to see how long and heavy the scribed lines show. Mark the center of the lines and place a trial weight on the heel of the wheel blade opposite the heavy side — 180 degrees away from the center mark.
 6. "U" shaped or hairpin type clips can be used as trial weights; being made from sheet metal or bar stock. Weights should be made so they can be forced on the heel (inside) of a wheel blade where they will not fly off. Some clients have had good results with small "C" clamps.
 7. Size of weight will be determined by length of lines on the shaft. Short lines will indicate fan badly out of balance and a larger weight should be used.
 8. After the trial weight is placed on the heel of the blade, run the fan again and rechalk the shaft. If the scribed lines are longer and the center of the lines have not shifted from the ones scribed initially, add more weight on the same blade and run again. Repeat test runs with varying weights until the lines are scribed all around the shaft. A balance will then be obtained. Note: Before restarting be sure to wait the necessary time to allow motor to cool.
 9. If the center of the lines shift from that scribed initially, move the weight forward or backward to the next wheel blade, so the center mark (heavy side) will not move from its initial position. Move weights less than 90° if vibration decreases. Move weights 180° if the lines remain in the same original position but vibration increases. When lines return to the original position, increase the weight until balance is obtained.
 10. If the weight is too great, the center of the lines will shift 180° from the initial run. Reduce weight until balance is obtained; chalk line scribed all around shaft.
 11. Most companies secure the clips in place however the following is best: When the position and amount of weight are established, the trial weight, or equal weights, may be welded or riveted to the wheel, on outside of flange or backplate 2" min. from OD of wheel. The weight of the weld bead or rivets should be taken into account. Ground wheel to housing when welding electrically to prevent damage to bearings.
 12. If chalk marks extend all the way around the shaft but considerable vibration persists, a weak foundation or loose bolts might be the trouble.
- A fan handling clean air should not need balancing once it is balanced. Dust build-up on fan blades or wear can unbalance the fan. Periodic inspection of the fan should be made to determine amount of dust build-up or wear.

4. FAN TROUBLES/CORRECTION

In the event that trouble is experienced in the field, listed below are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense of factory service.

1. CAPACITY OR PRESSURE BELOW RATING

- a. Total resistance of system higher than anticipated.
- b. Speed too slow.
- c. Dampers or variable inlet vanes not properly adjusted.
- d. Poor fan inlet or outlet conditions.
- e. Air leaks in system.
- f. Damaged wheel.
- g. Incorrect direction of rotation.
- h. Wheel mounted backwards on shaft.

2. VIBRATION AND NOISE

- a. Misalignment of bearings, couplings, wheel or V-belt drive.
- b. Unstable foundation.
- c. Foreign material in fan causing unbalance.
- d. Worn bearings.
- e. Damaged wheel or motor.
- f. Broken or loose bolts and set screws.
- g. Bent fan or motor shaft.
- h. Worn coupling.
- i. Fan wheel or driver unbalanced.
- j. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
- k. Fan delivering more than rated capacity.
 1. Loose dampers or VIVs.
- m. Speed too high or fan rotating in wrong direction.
- n. Vibration transmitted to fan from some other source.
- o. Change in positioning of wheel on shaft from prior balancing.

3. OVERHEATED BEARINGS

- a. Too much grease in ball or roller bearings.
- b. Poor alignment.
- c. Damaged wheel or driver.
- d. Bent shaft.
- e. Abnormal end thrust.
- f. Dirt in bearings.
- g. Excessive belt tension.
- h. Unbalanced rotor.
 - i. Excessive fan temperature.
 - j. Lack of cooling water or air.

4. OVERLOAD ON DRIVER

- a. Speed too high.
- b. Discharging over capacity due to existing system resistance being lower than original rating.
- c. Specific gravity or density of gas above design value.
- d. Packing too tight or defective on fans with stuffing box.
- e. Wrong direction of rotation.
- f. Shaft bent.
- g. Poor alignment.
- h. Wheel wedging or binding on inlet bell.
- i. Bearings improperly lubricated.
- j. Motor improperly wired.
- k. Temperature of gas below design temperature.

SECTION V

MAINTENANCE AND LUBRICATION

1. TIME SCHEDULE

A definite time schedule for inspecting all rotating parts, dampers, VIV's, screens, air cooled bearing filters, etc. should be established. The frequency of inspection depends on the severity of operation and the locality. Inspections might be daily at first in order to set up the schedule.

2. AIR FLOW

Make sure there are no obstructions (dirt, rags, wood, etc.) to air flow in inlet or outlet ductwork. Bird screens, protective screens and louvres must be clean.

3. HOUSING — WHEELS — SHAFTS

All bolts should be checked periodically to insure tightness. Housing and Wheels should be inspected for wear and accumulations of dust and dirt. Clean thoroughly with steam or water jet, compressed air or a wire brush. This will help prevent an unbalanced condition. Cover bearings so water won't enter the pillow block while cleaning. Dirt in the housing and inlet boxes should be removed.

Fan wheels having badly worn blades and blade liners should be replaced or rebuilt. When wear is severe in specific areas due to abrasion, the worn places may be built up by welding, but be careful to prevent heat distortion and put the same number of weld rods on each blade which will tend to maintain wheel balance. All cracks must be removed and repaired. Be sure to ground wheel before welding. Refer Section II Fan Components for a sketch of wheel wear strips.

Rebuilt or repaired wheels may require balancing before being returned to service. (See Section IV Balancing)

Replace worn scroll and housing side liners, since a badly worn liner can fall onto the rotating wheel and cause serious damage. Refer Section II Fan Components for sketches of liners.

Fans handling high temperature gas or air should not be shut down until system cools. For prolonged shutdowns it is best to daily turn wheel one and one-third revolution (480°) to prevent the shaft from taking a permanent set.

Wheels are removable through the split housing section or through the fan inlets. When replacing wheel and shaft in housing be sure wheel will rotate in proper direction.

Never run the fan at a higher speed than it is designed for unless you check Buffalo Forge first.

4. BEARINGS

Bearings on high speed fans often are designed to run hot (100°F to 200°F). Therefore, do not replace a bearing because it feels hot to the touch. Check the temperature of the pillow block with a pyrometer or contact thermometer.

Ball or roller bearing pillow blocks can have total temperatures of 200°F . Ring oiled sleeve bearings may go up to 170°F . oil film temperature before the cause of high temperature need be investigated. With water cooled bearings, check leaving cooling water temperature to be under 100°F .

unless designed for higher water temperature. Condensation in the oil is a possibility if the water temperature is too cold.

5. LUBRICATION OF ANTI-FRICTION BEARINGS

Bearings on assembled fans receive their initial lubrication at Buffalo Forge, but must always be checked prior to operation. Bearings shipped separate from the fan or as replacements are not lubricated before shipping. Lubrication data sheets on Page 25 for standard conditions or G1001 for special service conditions are furnished with each fan and must be consulted. Before lubricating the bearing must be clean and free from all dirt and contaminants. This can be done by washing the bearing with a clean petroleum solvent and drying carefully with air or clean rags. All rust on the shaft, pillow block or bearing must be removed before proceeding.

GREASE LUBRICATION

For grease lubricated ball or roller bearing pillow blocks, a good grade of grease, free from chemically or mechanically active material should be used.

Lube data sheets list the lubricant installed at the factory in the particular bearings furnished on your Buffalo fan. For best results, use the same grease when relubricating. Mixing of different lubricants is not recommended. If necessary to change to a different grade, make, or type of lubricant, flush bearings thoroughly before changing. Regreasing will vary from 3 months to a year depending upon hours of operation, temperature and surrounding conditions.

FREQUENCY OF RELUBRICATION

The frequency of relubrication to avoid corrosion and to aid in the purging out of any solid or liquid contaminants is difficult to establish as a hard and fast rule since it can vary considerably for various types of applications. It is advocated that the best approach to the frequency of relubrication is for the user to conduct an experimental test program where possible for his particular type or piece of equipment or obtain this information through accumulation of field experience. The experimental phase can be accomplished by relubricating the bearings at pre-established intervals and observe the condition of the grease as it is purged out of the seals or by periodic examination of the grease in the housing. The average type of application where the environmental conditions are clean and the bearings subjected to normal room temperature only can quite often be successfully lubricated every three or four months to a period of six months. On the other hand, the exposure of bearings to either dirty or contaminated operating conditions of high temperatures will require that they be relubricated at more frequent intervals. A tentative relubrication guide based on variable en-

Environmental and operating temperature conditions is tabulated below:

Operating Condition		Bearing Operating Temperature	Greasing Intervals
<u>Dirt</u>	<u>Moisture</u>		
Fairly clean	None	32°F. to 120°F.	6 to 12 months
		120°F. to 160°F.	1 to 12 months
		160°F. to 200°F.	1 to 4 weeks
Moderate to extremely dirty	None	32°F. to 160°F.	1 to 4 weeks
		160°F. to 200°F.	1 week
Fairly clean	Heavy moisture & direct water splash	32°F. to 200°F.	1 week

When grease is added, use caution to prevent any dirt from entering the bearing. The pipe plug or grease relief fitting should be open when greasing to allow excess grease to flow out. The pillow block should be about 1/3 full, as excess grease may cause overheating. Use low pressure grease gun.

NAME AND TYPE OF GREASE USED IN BEARINGS FURNISHED WITH BUFFALO FORGE CO. EQUIPMENT

BEARING MFR.	BEARING TYPE	GREASE	GREASE BASE
FAFNIR	LAK, RAK, LCJ, RCJ, LCJO, RCJO, LSAO, RSAO	SHELL ALVANIA #3	LITHIUM
	SAOL	MOBIL MOBILUX #2	LITHIUM
	MUOA-IN B.F. CO. ARR. #2 PILLOW BLOCK G-KRR-IN B.F. CO. ARR. #2 TRIPOD BLOCK	MOBIL MOBILUX #2	LITHIUM
LINKBELT	SERIES 200 & 300 B-22400 & B-22500	MASTER LUBRICANTS CO. LUBRIKO M32	SODIUM
	SERIES 6800 & 6900	MOBIL MOBILUX #2	LITHIUM
SEALMASTER	ALL TYPES	SOCONY-MOBIL ARMVAC #781	LITHIUM
SKF	SYR, FYR	SHELL ALVANIA #2	LITHIUM
	SY, FY	SHELL ALVANIA #3	LITHIUM
	SAF-22500 SAF-22600 SAF-1500 SAF-1600 SAF-22200 SAF-22300	MOBIL MOBILUX #2	LITHIUM

OIL LUBRICATION

Oil lubricated ball or roller bearings should use mineral oils, free from water sediment, acid, resin and other substances not derived from petroleum products. Where possible, the viscosity at the operating temperature should be at least 70 seconds Saybolt for ball bearings, 100 seconds Saybolt for roller bearings and 150 seconds Saybolt for spherical roller thrust bearings. Information regarding change in viscosity should be obtained from the oil supplier.

Oil lubricated bearings have an oil sight gauge or oil cup attached to the pillow block housing. With fan **stopped**, add oil until level is 1/4" below cap of oil cup (to prevent oil loss by capillary action) or until oil is at level mark indicated on

the sight gauge.

When not possible to stop fan to check oil level or add oil, an operating oil level must be determined. With oil at proper level, start and run fan until oil temperature stabilizes. The mark operating oil level on indicator. The minimum safe operating oil level is 1/8" below the established operating oil level.

Deterioration of oil is caused by heat, oxidation, catalytic reactions and dirt or water contamination. Therefore, periodic oil changes must be made. Oil changes should be made when the oil becomes dirty or cloudy.

For unusual operating conditions such as extremely dirty or wet atmospheres, consult your lubricant supplier.

6. LUBRICATION OF SLEEVE BEARINGS

Dodge sleeve bearing pillow blocks shipped mounted on assembled fan have oil added at the factory. The oil level should be checked before startup. Sleeve bearings shipped separate from fan do not have oil in them. Fill to top of red circle in oil gauge with good grade of turbine oil having suitable rust and oxidation inhibitors. After placing in operation, remove inspection covers and check oil rings to see that they are rotating freely and bringing up oil.

Temperature on Dodge plain sleeveoil pillow blocks reach 10 to 70° F above room temperature; de-

crease as operation continues.

Observe operation frequently first few days. If noise develops, check alignment of pillow block housing, collar runout, plunger screw and all operating parts.

Oil should be changed when it becomes cloudy or dirty.

For unusual or severe operating conditions, consult your lubricant supplier.

Before initial starting and after long shut downs add oil through inspection caps and rotate shaft by hand one or two revolutions.

TYPICAL RECOMMENDED OILS

ROOM TEMP. °F AT START UP	SPEED	TYPICAL OIL
Below -10°	All	Refer Bearing Mfg.
-10° to 32°	All	SAE 10
32° to 70°	Low High	SAE 20 SAE 10
Above 70°	Low High	SAE 30 SAE 10 or 20

TYPICAL OIL VISCOSITIES

OIL	VISCOSITY
SAE 10 Oil	Sus 183 @ 100°F 46 @ 210°F
SAE 20 Oil	Sus 348 @ 100°F 57 @ 210°F
SAE 30 Oil	Sus 489 @ 100°F 65 @ 210°F

DODGE SLEEVEOIL GENERAL DATA

TABLE VIII

SIZE	COOLING WATER IF REQUIRED (gals. per min.)	OIL SUMP CAPACITY (pints)	WATER PIPE SIZE (inches)		THRUST COLLAR CLEARANCE (thousandths)	
			BABBITT LINER	BRONZE LINER	BABBITT LINER	BRONZE LINER
1-7/16	—	3/8	—	—	8-12	—
1-11/16	.5	1/2	1/4	—	8-12	—
1-15/16	.55	1/2	1/4	—	8-12	—
2-3/16	.6	5/8	1/4	—	8-12	—
2-7/16	.75	15/16	1/4	—	8-12	—
2-11/16	1.0	1-1/8	1/4	—	8-12	—
2-15/16	1.25	1-1/8	1/4	—	8-12	—
3-7/16	1.5	2-1/16	1/4	—	8-12	—
3-15/16	1.75	3-1/8	1/2	1	8-12	9-14
4-7/16	2.25	4	1/2	1	8-12	9-14
4-15/16	2.5	5-5/8	1/2	1-1/4	8-12	10-15
5-7/16	3	6-1/4	1/2	1-1/4	8-12	10-16
6	4	8-1/4	3/4	1-1/4	8-12	12-18
7	5	15	3/4	1-1/4	8-12	14-20
8	6.5	20	3/4	1-1/4	8-12	16-22
9	8	20 (24 w.c.)	1-1/4	2	8-12	16-22
10	9	20 (40 w.c.)	1-1/2	2-1/2	8-12	16-22

7. CIRCULATING OIL LUBRICATION

The Circulating Oil Lubrication System is generally composed of:

1. One Positive displacement main oil pump direct driven by the main fan shaft.
2. One positive displacement, flooded suction, motor driven auxiliary oil pump.
3. One water cooled heat exchanger to keep oil

temperature between 80°F and 130°F.

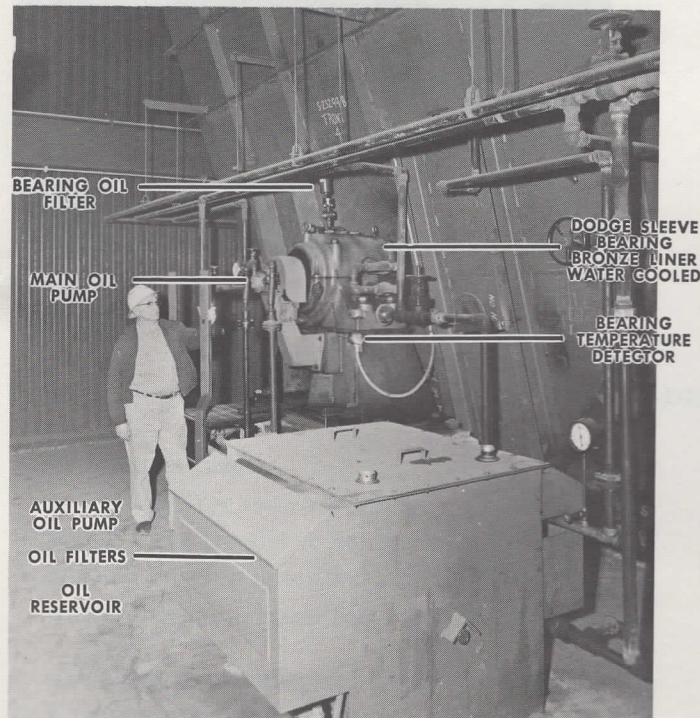
4. Two main oil filters.
5. One oil reservoir tank.
6. Instrumentation.
7. Sight flow indicators.

Detailed drawings and complete erection, start-up, operation, and maintenance instructions are furnished with each circulating oil lubrication system. During erection of the oil piping, be careful to see the system is free from dirt, grit, weld spatter, shavings, etc. The piping system must be thoroughly cleaned and flushed before connecting to the bearings. Clean filters before the initial fan start-up.

Basic circulating oil lubrication system operation for a typical system is as follows: The auxiliary oil pump is started. Oil passes through the auxiliary oil pump strainer, the auxiliary oil pump, back pressure relief valve, auxiliary system filter, the common oil cooler, individual bearing filters, the sleeve bearings and then by gravity flows back to the reservoir tank.

After the auxiliary oil system is properly functioning the pressure switches allow the fan motor to be started. As the fan comes to operating speed the main oil pump begins to pressurize the oil system. When the main oil pump exceeds a given pressure on a pressure switch, the auxiliary oil pump is shut down. The flow of oil is from the tank, through a suction strainer, the main oil pump, back pressure relief valve, main oil system filter, the common oil cooler, individual bearing filters, the sleeve bearings and then by gravity back to the reservoir tank.

If for any reason the main oil pump pressure drops, a pressure switch reactivates the auxiliary oil pump. Normally an alarm device will show that the auxiliary pump has been started. The auxiliary oil pump must be operated for approximately 15 minutes after the fan is stopped for shutdown or emergency purposes. This operation dissipates the heat from the bearings.



8. ALIGNMENT

Alignment of fan bearings, flexible coupling, wheel and inlet bells should be checked at regular intervals. Misalignment can cause bearing or motor overheating, wear to bearing dust seals, bearing failure and unbalance.

9. FLEXIBLE COUPLINGS

All metal couplings such as Falk Steelflex, Fast gear type and Waldron gear type require periodic lubrication inspections. Lubricant should be maintained at proper level and be free of contaminants. Other flexible couplings such as Thomas disc-ring, T. B. Wood's rubber insert, Poole's rubber insert couplings do not need lubrication. Rubber bushed couplings should be inspected for wear of pins and bushings. Refer coupling manufacturer for specific recommendation on lubrication.

In the absence of coupling manufacturers' lubrication instructions, the following can be used:

OILS: Use a mineral base oil having a viscosity no lighter than 150 SSU. Gear oil SAE 140 or #8 AGMA oil is suitable.

GREASES: Esso Fibre Grease C. Atlantic Lubricant #17. Shell Alvania Grease #2. Litholine Multi-Purpose Grease. Marfak #1 Grease.

To re-lubricate, remove both lube plugs (only one on Falk coupling — other plug is a grease fitting) and add lubricant until excess runs out lower opening. Replace lube plugs.

10. V-BELT DRIVE

Check belt wear, alignment of sheaves and belt tension. Replace belts with a complete set of matched belts. Since new belts will not work properly with used belts due to difference in lengths. Belts must be free of grease.

11. DAMPERS AND VIV's

All linkage connections should be tight. All automatic dampers should be checked for freedom of movement. Blades should close tightly in closed position. Make adjustments as required. Operating motors and controls should be observed through an operating cycle. Clean dampers and VIV's and inspect for corrosion and erosion.

12. REPAINTING

Repainting of exterior and interior parts of fans and ducts will extend the service life. Select paints which will withstand the operating temperature. For normal temperature, a good machinery paint may be used. If moisture is excessive, or if fans are exposed to the weather, bitumastic paints are suitable. Corrosive fumes require all internal parts to be wire brushed, scraped clean and repainted with an acid resisting paint. Competent advice should be secured when corrosive fumes are present.

13. MOTOR MAINTENANCE

Blow out open type motor windings with low pressure air to remove dust or dirt. Air pressures above 50 psi should not be used as high pressures may damage insulation and blow dirt under loosened tape. Dust can cause excessive insulation temperatures.

Make certain motor is not overloaded. Check amps with nameplate.

KEEP MOTORS DRY. Where motors are idle for a long time, single phase heating or small space heaters might be necessary to prevent water condensation in windings.

Excessive starting of **large motors** may burn out the motor. Consult the manufacturer for maximum allowable frequency of starts.

14. MOTOR OR TURBINE BEARINGS

Lubricate motor or turbine bearings according to the manufacturer's recommendations. **DO NOT OVER LUBRICATE.** Motor manufacturer's lubrication recommendations are printed on tags attached to the motor. Should these tags be missing, the following may be followed:

1. Motors having pipe plugs or grease fittings should be re-lubricated while warm and at stand still. Replace one pipe plug on each end shield with grease fitting. Remove other plug for grease relief. Use low pressure grease gun and

lubricate until new grease appears at grease relief. Allow motor to run for 10 minutes to expel excess grease. Replace pipe plugs.

2. Motors not having pipe plugs or grease fittings can be re-lubricated by removing end shields, cleaning grease cavity and refilling 3/4 of circumference of cavity.
3. Recommended re-lubrication intervals — general guide only.

H.P. RANGE	STANDARD DUTY 8 HR./DAY	SEVERE DUTY 24 HR./DAY Dirty, Dusty	EXTREME DUTY VERY DIRTY High Ambients
1½-7½	5 yrs.	3 yrs.	9 mos.
10-40	3 yrs.	1 yr.	4 mos.
50-150	1 yr.	9 mos.	4 mos.

4. These ball bearing greases or their equivalents are satisfactory for ambients from -15°F. to 130°F. For motors:

Mobilplex EP #1 — Socony Mobil Oil Co.

Alvania grease #2 — Shell Oil Co.

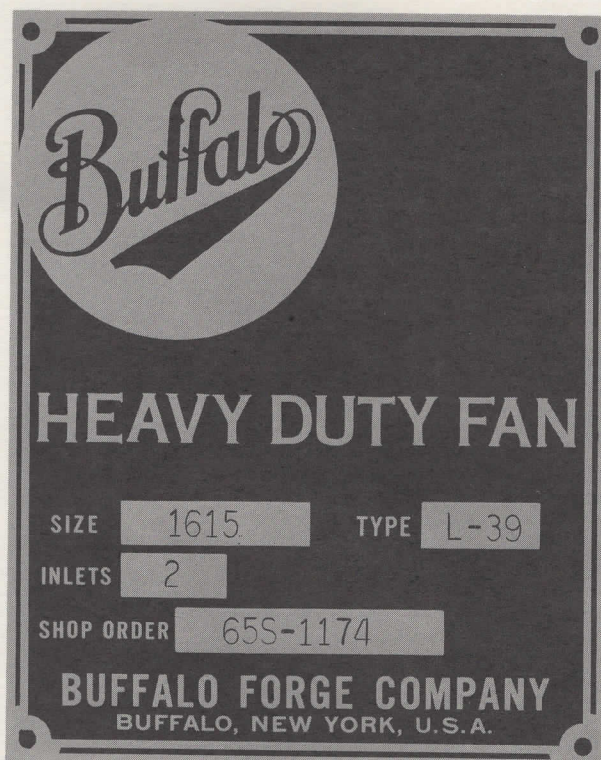
Andok B grease — Esso Standard Oil Co.

Prestige #42 grease — Sun Oil Co.

15. ORDERING SPARE PARTS

Contact the local Buffalo Representative or the factory and supply the following information:

1. Fan shop order number (stamped on nameplate).
2. Fan size and type (stamped on nameplate).
3. Fan arrangement.
4. Description of part required.
5. Pattern number if part is a casting.
6. Special paints or coatings.



A rectangular nameplate for a Buffalo Heavy Duty Fan. At the top left is the Buffalo logo, which consists of the word "Buffalo" in a stylized script font inside a circle. Below the logo, the words "HEAVY DUTY FAN" are printed in large, bold, sans-serif capital letters. Underneath this, there are four fields for specifications: "SIZE" with the value "1615", "TYPE" with the value "L-39", "INLETS" with the value "2", and "SHOP ORDER" with the value "65S-1174". At the bottom of the plate, the text "BUFFALO FORGE COMPANY" is printed in bold, sans-serif capital letters, with "BUFFALO, NEW YORK, U.S.A." in a smaller font below it.

HOUSING — specify rotation and discharge.

WHEEL — be sure to indicate direction of rotation of fan and type of wheel (flange, cone or paddle) and the operating speed. If the wheel is the back plate type, specify whether hub location is internal or external to the backplate. The bore and key-way dimensions are also required.

SHAFT — be sure to indicate type and make of bearings used. Length and location of shaft extensions are also required.

BEARINGS — the following information should be indicated when ordering various types of bearings:

Anti-Friction Bearings

1. State whether ball or roller
2. Manufacturer
3. Size and number
4. Fixed or floating
5. Parts required

Dodge Ring Oiled Sleeve Bearings

1. Size of bearing
2. Babbitted or bronze sleeves
3. Plain, water jacketed, or air cooled
4. Whether fixed or held bearing
5. Parts required
6. Bronze thrust plates if held bearing

RECOMMENDED SPARES

1. For fan bearings
 - a. Oil seals for sleeve or roller
 - b. Oil rings for sleeve bearings
 - c. Held bearing liners for sleeve bearings
 - d. Replacement races including adapter set for roller
 - e. Gasket for bearing splits
2. V-belts for V-belt driven fans
3. Asbestos stripping for housing splits, shaft seals, etc.
4. When wear or corrosion may be severe
 - a. Housing scroll liners
 - b. Housing side liners
 - c. Fan wheel
 - d. Fan shaft

SALES REPRESENTATIVES

ALBANY, NY
 ALLENTOWN, PA
 ATLANTA, GA
 BALTIMORE, MD
 BIRMINGHAM, AL
 (BOSTON) WAKEFIELD, MA
 BOUND BROOK, NJ
 BUFFALO, NY
 CHARLOTTE, NC
 CHICAGO, IL
 CINCINNATI, OH
 CLEVELAND, OH
 COLUMBUS, OH
 DALLAS, TX
 DAVENPORT, IA
 DENVER, CO
 DES MOINES, IA
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 GREENSBORO, NC
 GREENVILLE, SC
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In Canada:

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 HAMILTON, ONT.
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 SARNIA, ONT.
 SASKATOON, SASK.
 TORONTO, ONT.
 VANCOUVER 10, B.C.
 WINNIPEG, MAN.

In Mexico:

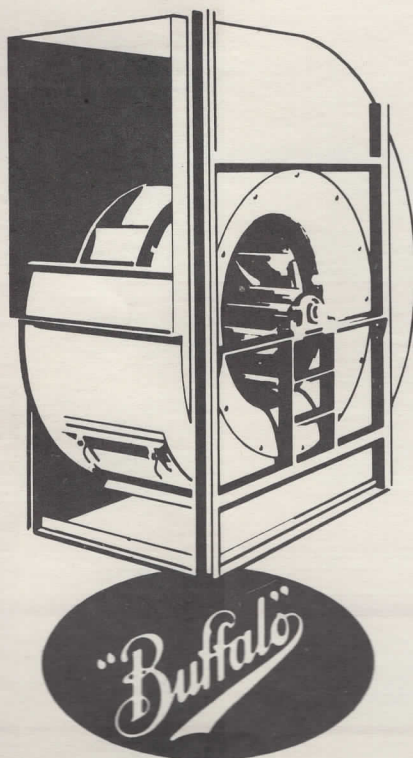
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Buffalo Air Handling Equipment to —
 Move • Heat • Cool •
 Humidify • Dehumidify
 and clean air and
 other gases —

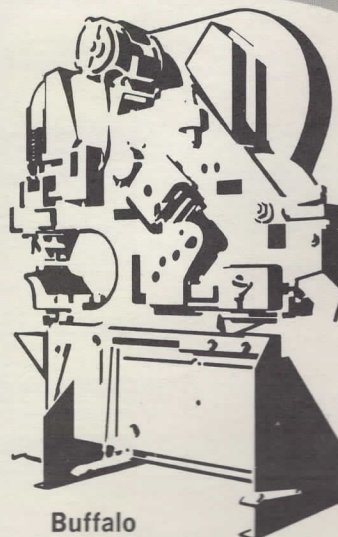
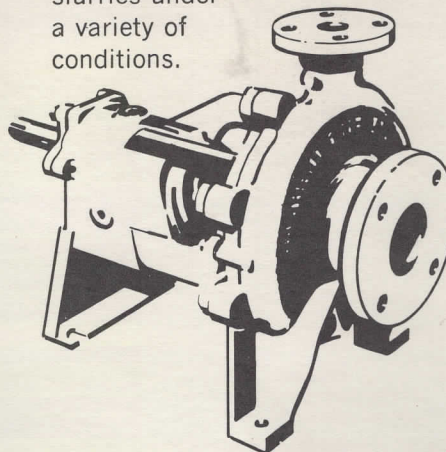
FANS - Centrifugal •
 Axial Flow • Propeller
 • Industrial Process
 • Heavy Duty.

ROOF VENTILATORS

CABINETS - Air Conditioning
 • Heating and Ventilating •
 Air Pollution Control •
 Scrubbers • Dust Collectors
 • Air Washers • Humidifiers
 • Dehumidifiers, etc.



Buffalo Centrifugal Pumps to handle most
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 slurries under
 a variety of
 conditions.



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