How to Use This Manual

This manual provides detailed instructions on installation and maintenance of parallel shaft Types DHP, DHF, DHB, and right angle Types DBP, DBF, & DBB high torque drives. Use the table of contents below to locate required information.

CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL FOR OPTIMUM PERFORMANCE AND TROUBLE FREE SERVICE OF YOUR FALK DRIVE.

Table of Contents

Introduction

Credit for long service and dependable operation of a gear drive is often given to the engineers who designed it, or the craftsmen who constructed it, or the sales engineer who recommended the type and size. Ultimate credit belongs to the mechanic on the job who worked to make the foundation rigid and level, who accurately aligned the shafts and carefully installed the accessories, and who made sure that the drive received regular lubrication. The details of this important job are the subject of this manual.

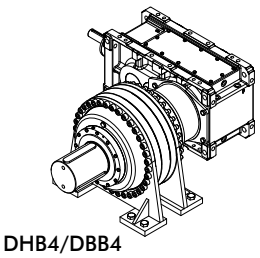
The Drive One High Torque Drive consists of a single stage planetary final drive connected to the standard Drive One solid low speed shaft. A mounting adapter attaches the planetary housing to the Drive One housing. DHC3 (parallel shaft) and DBC3 (right angle/parallel shaft) triple reduction drives in Sizes M1160 through M1210 are combined with a single reduction planetary drive to create quad reduction configurations, as shown in Table 1.

TABLE 1 — High Torque Drive Configurations

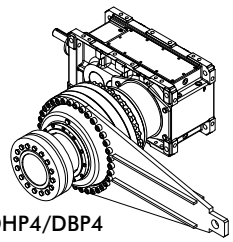
DRIVE TYPE	Mounting	Output Shaft	Torque Arm
DHB4/DBB4	Two Feet	Solid	. . .
DHP4/DBP4	Shaft	Hollow w/Shrink Disc	Single Sided
DHF4/DBF4	Shaft	Solid w/Moment Coupling	Single Sided

NAMEPLATE — Operate Falk/Rexnord gear drives only at power, speed and ratio shown on the nameplate. Before changing any one of these, submit complete nameplate data and new application conditions to Factory for correct oil level, parts, and application approval.

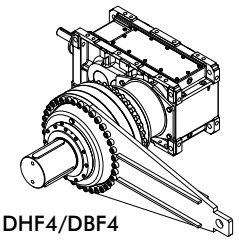
DISASSEMBLY AND ASSEMBLY — Disassembly & assembly instructions and parts guides are available from Factory or Rexnord Representatives. When requesting information, please give complete data from the nameplate on the gear drive; Model, M.O. Number, Date, RPM, and Ratio.



DHB4/DBB4



DHP4/DBP4



DHF4/DBF4

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members. Lock out power source and remove all external loads from drive before servicing drive or accessories.

Warranty

Rexnord Industries, LLC (the "Company") warrants that Drive One gear drives (I) conform to Company's published specifications, and (II) are free from defects of material for three years from the date of shipment. Company does not warrant any non-Company branded products or components (manufacturer's warranty applies) or any defects in , damage to, or failure of products caused by: (I) dynamic vibrations imposed by the drive system in which such products are installed unless the nature of such vibrations has been defined and accepted in writing by Company as a condition of operation; (II) failure to provide suitable installation environment; (III) use for purposes other than those for which designed, or other abuse or misuse; (IV) unauthorized attachments, modifications or disassembly, or (V) mishandling during shipping.

Installation Instructions

The following instructions apply to standard Falk Types DHP, DHF, DHB, DBP, DBF, & DBB high torque drives. If a drive is furnished with special features, refer to the supplementary instructions shipped with the drive.

WELDING — Do not weld on the gear drive or accessories without prior approval from the Factory. Welding on the drive may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval could void the warranty.

NOTE: Drives equipped with cooling fans may require removal of shroud when installing foundation fasteners.

EFFECTS OF SOLAR ENERGY — If the gear drive operates in the sun at ambient temperatures over 38°C (100°F), then special measures should be taken to protect the drive from solar energy. This protection can consist of a canopy over the drive or reflective paint on the drive. If neither is possible, a heat exchanger or other cooling device may be required to prevent the sump temperature from exceeding the allowable maximum.

MOUNTING POSITION — Standard mounting positions for types DH & DB are with the input and output shafts horizontal.

Allowable mounting angles for standard oil levels are;

	Bridge Slope	Kiln Slope
DH & DB	0° Up & 4° Down	± 1.5°

Consult Factory for other angles.

If a gear drive is ordered for non-standard mounting positions, refer to the instructions provided with the drive for oil levels and bearing lubrication. If it is necessary to mount the gear drive in a different position from which it was ordered, refer to Factory for required changes to provide proper lubrication.

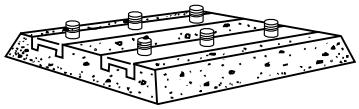
Installation – DHB/DBB – Foot Mounted

FOUNDATION, GENERAL — To facilitate oil drainage, elevate the gear drive foundation above the surrounding floor level. If desired, replace the drive oil drain plug with a valve, but provide a guard to protect the valve from accidental opening or breakage.

When an outboard bearing is used, mount drive and outboard bearing on a continuous foundation or bedplate, and dowel both in place.

FOUNDATION, STEEL — When mounting gear drive on structural steel, it is recommended that an engineered design be utilized for a pedestal, adapter base or bed to provide sufficient rigidity, to prevent induced loads from distorting the housing and causing gear misalignment. In the absence of an engineered design, it is recommended that a base plate, with thickness equal to or greater than the thickness of the drive feet, be securely bolted to steel supports and extend under the entire planetary drive foot mounting outline.

FOUNDATION, CONCRETE — If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. For the best type of mounting, grout structural steel mounting pads into the mounting base, as illustrated, rather than grouting the drive directly into the concrete.



Gear Drive Alignment

FOOT MOUNTED DRIVES – Align drive with driven equipment by placing broad, flat shims under all mounting pads. Jack screw holes are provided by mounting feet to facilitate alignment. Start at the low speed shaft end and level across the length and then the width of the drive. Check with a feeler gauge to make certain that all pads are supported to prevent distortion of housing when drive is bolted down. After drive is aligned with driven equipment and bolted down, align prime mover to drive input shaft. Foot mounting bolt requirements are shown Table 2

TABLE 2 — Foot Mounting Fasteners

DRIVE SIZE	Total Number of Bolts Required	Thread Size x Pitch	ISO Class	Tightening Torque			
				Nm		ft-lb	
				Min	Max	Min	Max
M1160 & M1170	8	M30	8.8	1300	1570	960	1160
M1180 & M1190	8	M42	8.8	3660	4470	2700	3300
M1200 - M1210	8	M48	8.8	5490	6710	4050	4950

If equipment is received from the Factory mounted on a bedplate, the components were accurately aligned at the Factory with the bedplate mounted on a large, flat assembly plate. Shim under the bedplate foot pads until the gear drive is level and all feet are in the same plane.

Check high speed shaft coupling alignment. If the coupling is misaligned, the bedplate is shimmed incorrectly. Re-shim bedplate and recheck high speed coupling alignment. If necessary, realign motor.

Motors and other components mounted on motor plates or motor brackets may become misaligned during shipment. ALWAYS check alignment after installation.

Shaft Mounted Drives – General

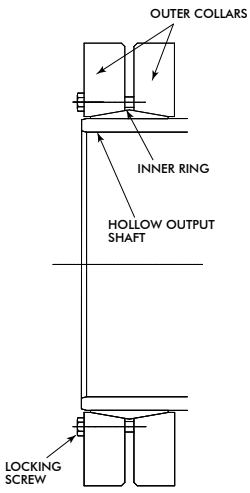
Shaft mounted drives should never be mounted in a manner that restricts natural movement of the drive. They should be allowed to move freely with shaft on which it is mounted. Shaft mounted drives should always be used in conjunction with a torque reaction arm attached to the planetary that can absorb the torque reaction created in either direction of rotation.

Motors and other components mounted on motor plates or motor brackets may become misaligned during shipment. ALWAYS check alignment after installation.

Shaft mounted drives are not to be used with swing base or torque arm attached to Drive One housing.

Installation – DHP/DBP – Shaft Mounted with Shrink Disc

The shrink disc is a keyless frictional locking device designed to mechanically compress or shrink the hollow output shaft onto a solid shaft stub integral with driven shaft. A mechanical interference fit is established between hollow shaft inside diameter and driven stub.



Shrink disc is supplied ready for installation. However, prior to installation it may be necessary to remove spacers used for shipping.

Verify lubrication of locking screw threads, screw head bearing area and tapers of inner ring. If necessary lubricate with molybdenum disulfide grease – Molykote Gn paste or equal.

Never tighten locking screws before shaft installation as shrink disc inner ring and/or hollow shaft can be permanently contracted (even at relatively low tightening torques).

Clean hollow shaft outside diameter and shrink disc bore. Lightly lubricate (light mineral oil) outside diameter before assembling shrink disc on hollow shaft.

Carefully clean driven shaft stub and hollow shaft bore of any lubricant prior to mounting hub onto shaft. **THIS STEP IS CRITCAL AS ANY LUBRICANT ON SHAFT/HUB BORE INTERFACE WILL GREATLY REDUCE TORQUE CAPACITY OF SHRINK DISC CONNECTION.**

Install shrink disc over hollow output shaft and install hollow shaft onto driven shaft stub and establish the correct position.

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Hand tighten 3 or 4 equally spaced shrink disc locking screws and make sure outer collars of shrink disc are parallel. Hand tighten remaining locking screws. Disc outer collar faces need to be parallel to each other and perpendicular to shaft. The allowable gap deviation between the collars is 1.5 mm (.060").

The number, size and tightening torque for shrink disc locking screws are are shown Table 3.

TABLE 3 — Shrink Disc Locking Screws

DRIVE SIZE	Number of Locking Screws	Thread Size	Tightening Torque	
			Nm	ft-lb
M1160 & M1170	16	M20	490	360
M1180 & M1190	24	M20	490	360
M1200 & M1210	21	M24	840	620

Set a torque wrench to approximately 5% higher than specified tightening torque. Tighten locking screws in either a clockwise or counterclockwise sequence. Use approximately ¼ turns (90°) for several passes (even if initially some locking screws require a very low torque to achieve ¼ turn). Continue until ¼ turns can no longer be achieved.

Continue to apply the overtorque for 1 or 2 more passes.

The above procedure compensates for system related relaxation of locking screws since tightening of a given screw will always relax adjacent screws. Without overtorquing an infinite number of passes would be needed to reach the specified tightening torque.

Reset torque wrench to specified tightening torque and check all locking screws. No screw should turn. If a screw turns reset torque wrench to 5% overtorque and apply for one or two more passes. Reset torque wrench to specified torque and recheck all locking screws. Continue this procedure until no screws turn at the specified torque.

Drive should never be mounted in a manner that restricts natural movement of the drive. Drive should be allowed to move freely with shaft on which it is mounted. To absorb driving torque reaction the shaft mounted drive is equipped with a torque reaction arm. The anchor of the torque arm must transmit the torque reaction force to a suitable structure but at the same accommodate both translational (±5 mm, ±.20 in) and rotational (±5 deg) motion of the anchor end.

For removal of drive from shaft loosen shrink disc locking screws ½ turn at a time progressing around outer collar in either direction until shrink disc is loose on hollow shaft.

DO NOT remove shrink disc locking screws until outer collars are disengaged from inner ring to prevent sudden release of collars.

DO NOT completely remove locking screws. Support drive assembly and slide drive off of driven shaft.

Clean and lubricate shrink disc components per preceding instructions for reinstallation.

Installation – DHF/DBF – Shaft Mounted With Moment Coupling

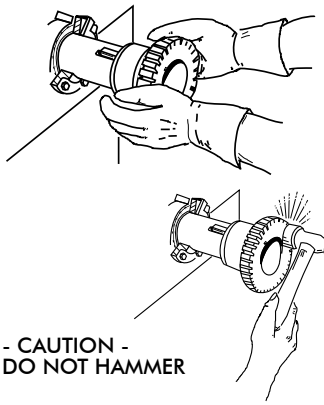
Drive is to be connected to the driven shaft using a rigid moment coupling. For Falk Type MCF follow the installation instructions in Manual 458-862. For non-Falk coupling, follow manufacturer's instructions.

Drive should never be mounted in a manner that restricts natural movement of the drive. Drive should be allowed to move freely with shaft on which it is mounted. To absorb driving torque reaction the shaft mounted drive is equipped with a torque reaction arm. The anchor of the torque arm must transmit the torque reaction force to a suitable structure but at the same time accommodate both translational (±5 mm, ±.20") and rotational (±5°) motion of anchor end.

Shaft Connections

WARNING: Provide suitable guards in accordance with local and national standards.

COUPLING CONNECTIONS — The performance and life of any coupling depends largely upon how well the coupling is installed and serviced. Refer to the coupling manufacturer's manual for specific instructions.



CORRECT METHOD

Heat interference fitted hubs, pinions, sprockets or pulleys to a maximum of 135°C (275°F) and slide onto gear drive shaft.

INCORRECT METHOD

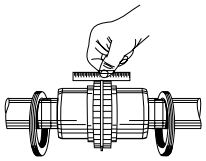
DO NOT drive coupling hub, pinion, sprocket or pulley onto the shaft. An endwise blow on the shaft/coupling may damage gears and bearings.

FALK COUPLINGS — (Except fluid type) Detailed installation manuals are available from Factory, your local Rexnord Representative or Distributor—just provide size and type designations stamped on the coupling. For lubricant requirements and a list of typical lubricants meeting Rexnord specifications, refer to appropriate coupling service manual.

FALK FLANGED TYPE RIGID COUPLINGS — These are typically used on drives with vertical output shafts. The low speed shaft extension ends of the solid vertical shaft drives are drilled and tapped to accommodate coupling keeper plates.

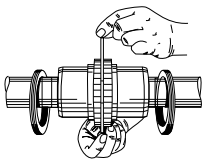
FALK FLUID COUPLINGS — Refer to the installation manual furnished with the Falk fluid coupling for installation and startup instructions.

GAP AND ANGULAR ALIGNMENT — If possible, after mounting coupling hubs, position the driving and driven equipment so that the distance between shaft ends is equal to the coupling gap. Align the shafts by placing a spacer block, equal in thickness to required gap, between hub faces, as shown at right, and also at 90° intervals around the hub. Check with feelers.



Steelflex Illustrated

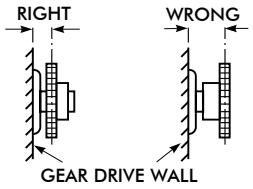
OFFSET ALIGNMENT — Align driving and driven shafts so that a straight edge will rest squarely on both couplings hubs as shown to the right and also at 90° intervals. Tighten foundation bolts of the connected equipment and recheck alignment and gap.

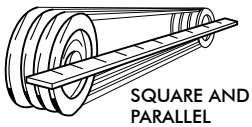


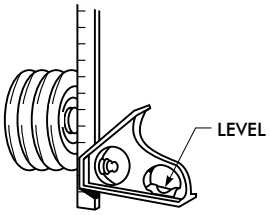
Steelflex® Illustrated

SPROCKETS, PULLEYS OR SHEAVES — Mount power take-offs as close to the gear drive housing as possible to avoid undue bearing load and shaft deflection.

Align the output shaft of the gear drive square and parallel with the driven shaft by placing a straightedge across the face of the sprockets or sheaves as illustrated. Check horizontal shaft alignment by placing one leg of a square against the face of the sheave or sprocket with the spirit level on the horizontal leg of the square.







DO NOT over tighten belts or chains. Adjust chains to manufacturers' specifications. Adjust belts as follows:

The ideal tension is the lowest tension at which the belt will not slip under peak load conditions. Check the belt tension frequently during the first 24 to 48 hours of run-in operation. Over tightening belts shortens belt and bearing life. Keep belts free from foreign material which may cause slippage. Inspect the V–belt periodically; tighten the belts if they are slipping.

OUTBOARD BEARING — Mount the outboard bearing and gear drive on a common foundation so that they will shift as an assembly if settling should occur. Bring the outboard bearing to the correct horizontal position with broad flat shims under the mounting pad. Align accurately so that the load is equally divided between the two drive bearings and the outboard bearing. Mount a stop bar against the pillow block foot on the load side when large horizontal load components are exerted on the pillow block.

PINION MOUNTING — Mount pinion as close to the drive as possible to avoid undue bearing load and shaft deflection. Refer to the Factory for pinion alignment instructions.

NON FALK COUPLINGS — Refer to manufacturers' installation and maintenance instructions.

BACKSTOPS — To prevent damage to backstops due to incorrect motor shaft rotation at start up, couplings are NOT assembled when gear drives are furnished with backstops.

After completing electrical connections, check motor and gear drive shaft rotations. If rotations are correct, complete alignment and assembly of coupling.

Lubrication

Drives are shipped without lubrication. **DO NOT OPERATE WITHOUT LUBRICATION**

Lubrication Requirements

Carefully follow lubrication instructions on the gear drive nameplate, warning tags, and installation manuals furnished with gear drive. Failure to follow instructions voids warranty.

Petroleum Based Lubricants

Industrial type (not automotive) petroleum based sulfur-phosphorous extreme pressure (EP) gear lubricants meeting specific requirements are required for ambient air temperatures of -9°C to +52°C (15°F to 125°F). An approved lubricant MUST be used. Approved lubricants meeting the specific requirements are listed in Table 5. Lubricants not listed may be used only after approval from Factory. Failure to use an approved lubricant voids warranty.

For drives operating outside the above temperature range refer to the "Synthetic EP Lubricants" section. Synthetic lubricants can also be used in normal climates.

WARNING: EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — EP lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA or NSF "H-1" classification are suitable for food processing applications. Consult Factory.

Viscosity

The proper grade for EP lubricants is found in Table 4. For cold and normal climate conditions refer to Table 6, and the "Synthetic EP Lubricant" section.

TABLE 4 — Viscosity Grade Requirements for Petroleum Based Ep (Extreme Pressure) Lubricants

Ambient Air Temperature ✱	Viscosity Grade	
	ISO-VG	AGMA
-9° to 16°C (15° to 60°F) 10° to 52°C (50° to 125°F)	220 320	5 EP 6 EP

✱ See section on oi pumps.

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump, cold temperature oil viscosity is very important. Lubricant viscosity at start-up generally should not exceed 2160 cSt (10,000 SSU). When exceeding this viscosity, pump cavitation is possible, reducing oil circulation to gear drive and possibly damaging the pump. A sump heater may be required or it may be possible to use a lower viscosity oil to minimize pump cavitation, refer to Factory.

Synthetic EP Lubricants

Synthetic EP lubricants of the polyalphaolefin (PAO) type meeting specific requirements are recommended for cold climate operation, high temperature applications, extended temperature range (all season) operation, and/or extended lubricant change intervals. The proper viscosity grade of

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synthetic lubricants is given in Table 6. An approved lubricant MUST be used. Approved synthetic lubricants meeting the specific requirements are listed in Table 7. Synthetic lubricants not listed may be used only after approval from Factory. Failure to use an approved lubricant voids warranty.

WARNING: SYNTHETIC EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — Synthetic lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturers' approval. Lubricants which meet USDA or NSF "H-1" classification are suitable for food processing applications.

TABLE 6 — Viscosity Grade Requirements for Synthetic EP (Extreme Pressure) Lubricants ‡

Ambient Air Temperature	ISO Viscosity Grade	AGMA Viscosity Grade
-12° to +52°C (+10° to +125°F)	320	6 EP
-34° to +27°C (-30° to +80°F)	150	4 EP

‡ Refer to the Factory for viscosity recommendations when ambient temperatures are below -34°C (-30°F) or above 52°C (125°F).

Seal Greases

All drives and some backstops have grease lubricated seals. Drives are shipped with NLGI #2 grease in the seal housing cavities unless otherwise specified. Refer to Table 8 for grease recommendations.

GREASE LUBRICATED SEALS — Drive One gear drives are furnished with grease purged seals which minimize the entry of contaminants into the drive. Drives are shipped with NLGI Grade #2 grease in the seal housing cavities unless otherwise specified. If grease could contaminate the product, as in the food and drug industries, it must be completely removed and replaced with grease that meets USDA or NSF "H-1" classification. Consult the Factory.

Oil Levels

Approximate oil capacity is shown on nameplate. Oil filling and level checking must be done statically (no drive operation) with oil with oil temperature 10°C to 52°C (50°F to 125°F). Never remove dipstick with drive operating.

Fill gear drive with oil to level indicated on oil dipstick. Allow sufficient time for oil to flow into planetary section. The DH or DB and planetary share the same oil sump and operate at the same oil level. The DH or DB dipstick oil level may be slightly below the oil sight on the side of the planetary, do not overfill as overheating and leakage may result. DH or DB gear drive can be filled though dipstick tube, oil fill plug or inspections cover. Clean area around fill location BEFORE removing dipstick, plug or cover to reduce the risk of debris getting into gear drive. Oil must be clean to maximize gear and bearing life. It is recommended to filter new oil when filling or adding oil to the gear drive.

The inspection cover is sealed with gasket eliminator. When installing inspection cover, apply a bead of Loctite 515 Gasket Eliminator* (or equivalent) around the perimeter of the inspection opening, making sure to circle the fastener holes.

* Product of Henkel Corp., Rocky Hill, CT

DRIVES WITH OIL PUMPS — Fill drive to level marked on the dipstick. Run the lubrication system for several minutes to fill system components. Verify that the pump is circulating oil properly, then recheck oil level and add oil if necessary.

Before starting the gear drive, rotate the input shaft to check for obstructions. Then start the drive and allow it to run without load for several minutes. Shut down and recheck oil level. If everything is satisfactory, the drive is ready for operation.

TABLE 5 — Petroleum Based Extreme Pressure (EP) Lubricants †

Maximum operating temperature of lubricants 93°C (200°F)

ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5 EP	6 EP
Viscosity, Centistokes (cSt) @ 40°C	198-242	288-352
Manufacturer	**Lubricant**	**Lubricant**
BP Lubricants	Energol GR-XP 220	Energol GR-XP 320
Castrol Industrial North America, Inc.	Castrol Alpha SP 220	Castrol Alpha SP 320
Chevron Products Company	Chevron Meropa 220	Chevron Meropa 320
Exxon Mobil Corporation	Mobilgear 600 XP 220	Mobilgear 600 XP 320
Shell Oil Company	Shell Omala 220	Shell Omala 320

† Minimum viscosity index of 90.

TABLE 7 — Synthetic Extreme Pressure (EP) Lubricants – Polyalphaolefin Type ★

ISO Viscosity Grade	150	220	320	460
AGMA Viscosity Grade	4 EP	5 EP	6 EP	7 EP
Viscosity, Centistokes (cSt) @ 40°C	135 - 165	198-242	288-352	414 - 506
Manufacturer	**Lubricant**	**Lubricant**	**Lubricant**	**Lubricant**
Castrol Industrial	Alphasyn EP 150	Alphasyn EP 220	Alphasyn EP 320	Alphasyn EP 460
Chevron Products Company	Tegra Synthetic Gear Oil 150	Tegra Synthetic Gear Oil 220	Tegra Synthetic Gear Oil 320	Tegra Synthetic Gear Oil 460
Exxon Mobil Corporation	Mobilgear SHC 150	Mobilgear SHC 220	Mobilgear SHC 320	Mobilgear SHC 460
Shell Oil Company	Omala Fluids HD 150	Omala Fluids HD 220	Omala Fluids HD 320	Omala Fluids HD 460

★ Minimum viscosity index of 140. Contains sulphur phophorous

Preventive Maintenance

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Tighten all external bolts and plugs where necessary. DO NOT adjust the internal gear or bearing settings in the drive, these were permanently set at the Factory.

AFTER FIRST MONTH — Proceed as follows:

1. Operate drive until sump oil reaches normal operating temperature. Shut down drive and drain immediately.
2. Immediately flush drive with new oil of the same type and viscosity grade as the original charge (warmed to approximately 38°C (100°F) in cold weather) by rapidly pouring or pumping a charge equal to 20 - 30% of the initial fill volume or until clean oil flows through the drain.
3. Close the drain and refill drive to correct level with new oil of the correct type and viscosity. It is recommended to filter new oil when filling or adding oil to the gear drive.

PERIODICALLY —

1. Check oil level in drive when it is stopped and at ambient temperature. Add oil if needed. If oil level is ABOVE the high oil level mark on dipstick, lower oil level to dipstick mark and have the oil analyzed for water content and other contaminants. Moisture in the oil may indicate that a seal or heat exchanger is leaking. If so, replace the defective part immediately and change oil. DO NOT fill above the mark indicated as leakage or undue heating may occur.
2. Check coupling alignment to make certain that foundation settling has not caused excessive misalignment or twisted gear drive. See coupling installation manual for alignment limits.
3. If drive is equipped with a fan, periodically clean accumulated foreign debris from the fan, guard, and deflector.
4. If drive is equipped with a torque arm, check for free movement.

Lubricant Changes

When changing oil, there are two oil drain plugs; one in the Drive One housing (either input or output end) and one in the planetary stage (planetary housing on Drive One side, 180° from air vent).

OIL ANALYSIS REPORT — Checking oil condition at regular intervals is recommended. Analyze oil samples approximately every 1000 hours for petroleum EP lubricants or every 3000 hours for synthetic EP lubricants. In the absence of more specific limits, the guidelines listed below may be used to indicate when to change oil:

1. Water content is greater than 500 ppm (parts per million) (0.05%).
2. Iron content exceeds 150 ppm.
3. Silicon (dust/dirt) exceeds 25 ppm, above reference sample from new oil container.
4. Copper content exceeds 75 ppm.
5. TAN (Total Acid Number) 50% increase above reference sample from new oil container.
6. Viscosity changes more than ±15%.

Laboratory analysis is recommended for optimum lubricant life and gear drive performance.

PETROLEUM EP LUBRICANTS — For normal operating conditions, change EP lubricant every 6 months or 2500 operating hours, whichever occurs first. Change oil more frequently when gear drives operate in extremely humid, chemical or dust laden atmospheres. In these cases, EP lubricants shall be analyzed to determine proper change interval. Refer to Table 6 for EP lubricant viscosity recommendations

SYNTHETIC EP LUBRICANTS — Synthetic EP lubricant change intervals can be extended to 8000 hours depending upon operating temperatures and lubricant contamination. Change oil more frequently when gear drives operate in extremely humid, chemical or dust laden atmospheres. In these cases, synthetic EP lubricants shall be analyzed to determine proper change interval. Refer to Table 8 for synthetic EP lubricant viscosity recommendations.

GREASE LUBRICATED SEALS – Depending on the frequency and degree of contamination (at least every six months or when changing oil in the drive), seals must be greased with NLGI Grade #2 grease. Clean grease fitting prior to greasing. Input shaft seal should be purged by slowly pumping fresh grease, WITH A HAND GREASE GUN, through the seal cavity until fresh grease is purged around the shaft. Wipe off purged grease. Output shaft seal assembly should be charged with approximately 140 grams (5 ounces) of grease WITH A HAND GREASE GUN. Do not exceed this amount.

Refer to Table 8 for NLGI Grade #2 greases. Some greases are of the EP type and may contain toxic substances not allowed in the food processing industry. Grease that meets the USDA or NSF "H-1" classification is suitable for food processing applications. Consult Factory.

CAUTION: *Rapid greasing with a power grease gun can force grease inward past the seals causing seal leaks.*

TABLE 8 — Lithium Based Greases

–18° to +93°C (0° to 200°F) ‡

Manufacturer	Lubricant
Amoco Oil Co.	Amolith Grease No.2
BP Oil Co.	Energrease LS EP2
Chevron U.S.A.	Industrial Grease Medium
Citgo Petroleum Corp.	Premium Lithium Grease No. 2
Conoco, Inc.	Multiplex Red
Mobil Oil Corp.	Mobilux EP2
Mobil Oil Corp.	Mobilith SHC 460 ★
Petro-Canada Products	Multipurpose EP2
Phillips 66 Co.	Multiplex Red
Shell Oil Co.	Alvania Grease 2
Shell Canada Ltd	Alvania Grease 2
Texaco Lubricants	Premium RB Grease

‡ High performance synthetic alternate.
★ For ambient or operating temperatures outside this range, review application with grease supplier or consult the Factory.

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Stored & Inactive Gear Drives

Each gear drive is protected with a rust preventative that will protect parts against rust for a period of 4 months in an outdoor shelter or 12 months in a dry building after shipment from the Factory.

If a gear drive is to be stored, or is inactive after installation beyond the above periods, drain oil from housing and spray all internal parts with a rust preventative oil that is soluble in lubricating oil or add "Motorstor"™ vapor phase rust inhibitor at the rate of 1.05 liters per cubic meter (one ounce per cubic foot) of internal drive space (5% of sump capacity). Refer to Table 9 for Motorstor quantities. Rotate the shafts several times by hand. Before operating, drives which have been stored or inactive must be filled to the proper level with oil meeting the specifications given in this manual. Refer to Manual 128-014 for "Start-up after Storage" instructions.

Periodically inspect stored or inactive gear drives and spray or add rust inhibitor every six months, or more often if necessary. Indoor dry storage is recommended.

Gear drives ordered for extended storage can be treated at the Factory with a special preservative and sealed to rust-proof parts for periods longer than those cited previously.

TABLE 9 — Motorstor/VCI-10 ★

DRIVE SIZE	Motorstor	
	Milliliters Per Drive	Ounces Per Drive
M1160 & M1170	180	6
M1180 & M1190	355	12
M1200 & M1210	590	20

★ Product of Daubert Chemical Company, Chicago, IL.

For storage, air vents must be sealed. The drive has two air vents ; one integral with Drive One DH or DB dipstick and one on top of single stage planetary. If sealed by removing and installing plugs the required sizes are ¾ inch BSPT for M1160 dipstick, 1 inch BSPT for M1170 through M1210 dipstick and 3/4 inch GAS for planetary air vent (all sizes).

Electric Fan Installation & Maintenance

Installation

The installation and troubleshooting of electric cooling fans are to be carried out by a qualified electrician according to the applicable local, state, province and federal codes. Inspect for any damage that may have occurred during transit. Check all bolts, screws, set screws, etc. Retighten as required. Before installing, rotate the blade to be sure it does not rub. Adjust if necessary. Before installation, read the entire manual carefully.

This guide is pertinent only to electric fans furnished by the Factory and manufactured by Multifan Inc. (can be verified from nameplate on the electric fan). In the event the electric fan furnished by the Factory is of a special nature (manufactured by an alternate fan manufacturer), please contact the Factory for appropriate electric fan installation and maintenance instructions.

General Safety Information

Warning: To reduce the risk of fire, electric shock, or personal injury, observe the following:

1. Use this electric fan only in the manner intended by the manufacture. If you have any questions, contact Factory.
2. Before servicing or cleaning the fan, switch the power off at the service panel and lock out to prevent the power from being switched on accidentally.
3. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and Occupational Safety and Health Act (OSHA).
4. Fan motor must be securely and adequately grounded.
5. All working parts should be grounded.
6. When cleaning electrical equipment always use an approved cleaning agent. See CLEANING in NOTES section, Page 9.
7. For general ventilation and cooling use only. Do not use if hazardous or explosive materials and vapors are present.

Guidelines For Installation

Before connecting the electric fan, check if the information on the fan motor name plate is in accordance with the actual main supply voltage, phase and frequency.

Warning: To reduce the risk of fire, electric shock, or personal injury, observe the following:

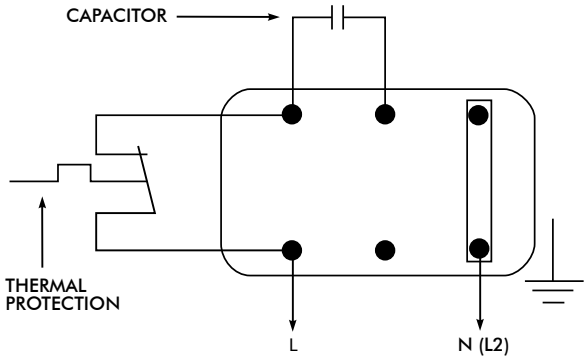
1. Switch off the main power supply and lock out before installing, servicing or making connections to the fan.
2. Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
3. The fan should be securely mounted. Recheck the mounting hardware and tighten as necessary.
4. The fan motor must always be grounded. The installation of a motor protection switch is recommended. See Figure 1 for wiring diagrams.
5. Mount the motor guard if removed. The motor guard must be installed at all times during operation to prevent injury to personnel by rotating fan blade.
6. Use liquid tight electrical fittings and conduit.

FIGURE 1

SINGLE PHASE
TYPE - E

1 PHASE 220V - 50Hz
1 PHASE 240V - 50Hz

1 PHASE 110V - 60Hz
1 PHASE 220V - 60Hz
1 PHASE 240V - 60Hz

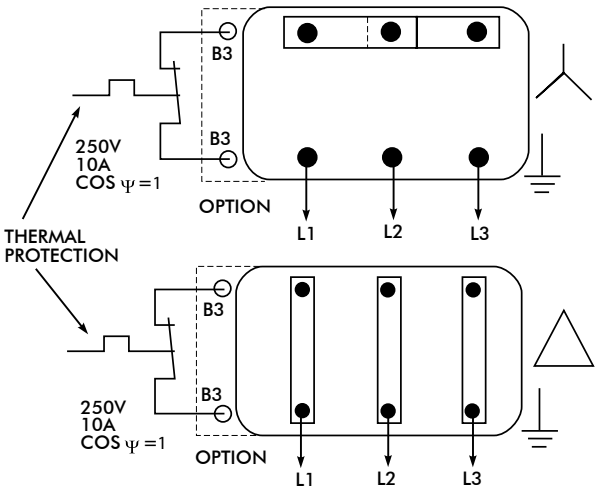


SINGLE PHASE
TYPE - D

3 PHASE

3 PHASE 220/380V - 50Hz
3 PHASE 230/400V - 50Hz
3 PHASE 240/415V - 50Hz

3 PHASE 220/380V - 60Hz
3 PHASE 208/360V - 60Hz
3 PHASE 265/460V - 60Hz



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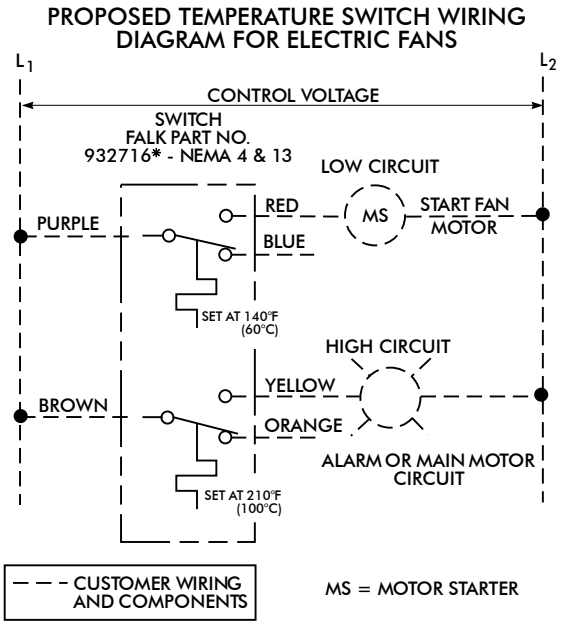
7. A temperature switch is provided to control oil sump temperature. See Figure 2 for proposed wiring. There are two separate circuits in the temperature switch. The low circuit is to operate the electric fan. It is recommended the fan motor be operated by the temperature switch through a motor starter relay (consult applicable local and national electrical codes). The high circuit is provided to operate either a high temperature alarm or main motor shutdown.

FIGURE 2



*AC RATING - INDUCTIVE LOAD - 50% PF
DC RATING - INDUCTIVE LOAD - L/R = 0.26

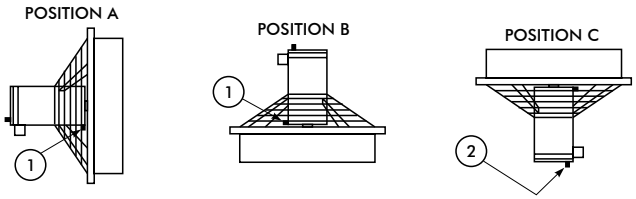
AC VOLTS	AMP	DC VOLTS	AMP
125	15	6-12••	15
250	15	24 ••	5
480	15	125	0.05
		250	0.03

* MAXIMUM CONTINUOUS CURRENT
••Reference only.

8. Connect power to the motor using an approved wiring method. See Figure 1 for connection diagrams.
9. Before starting the fan, double-check to ensure there are no obstructions that could interfere with proper fan operation and airflow. Verify proper fan rotation, resulting in air flow directed at the adjacent face of the gear drive.
10. Remove proper condensation plug. See Figure 3 below. Do not discard. Plug is to be used during cleaning.

FIGURE 3

Mounting Positions		
For Position A & B Remove Plug 1	**For Position C Remove Plug 2**	**Note: Never use copper or brass fastening materials**



NOTES:

AIR SUPPLY AND TEMPERATURE — Sufficient air supply over the motor must be assured in all circumstances. Limits of operating ambient temperature are 14°F to 113°F (–10°C to 45°C).

RESTRICTION ON USE — Fan blade material is Polypropylene which is unsuitable and/or not recommended for certain chemicals. The following is a partial list of unsuitable chemicals for guideline purposes.

Chloro-Sulphonic Acid	Nitric Acid	Chloroform
Mixture of HNO3-HCL	Esters	1:2 Dichloroethylene
Mixture of HNO3-H2SO4	Benzene	Trichloroethylene
Sulfuric Acid, fuming	Gasoline	Diethl Ether
Carbon Tetrachloride	Toluene	Chlorine, Liquid
Chlorobenzene	Xylene	

CLEANING — When cleaning fan, both condensation holes (Figure 3, Items 1 and 2) are to be temporarily plugged. If this is not done, guarantee is void. When cleaning electrical equipment, always use an approved cleaning agent.

Alignment Free Assembly and Installation - Welded Design

Introduction

The Alignment Free Drive design consists of a shaft mounted drive, bell housing, motor adapter plate, motor and coupling. When assembled, the bell housing, motor adapter, and motor locate off registers, resulting in alignment of the motor and gear drive shafts. Therefore, no additional alignment is required for the high-speed coupling.

Assembly Instructions

The bell housing is fastened to the drive's high speed end using cap screws through the four mounting holes on that face, (see Table 1 for size and torque). The bell housing will locate on the bevel head of the drive. Read instructions provided with high speed coupling prior to assembly.

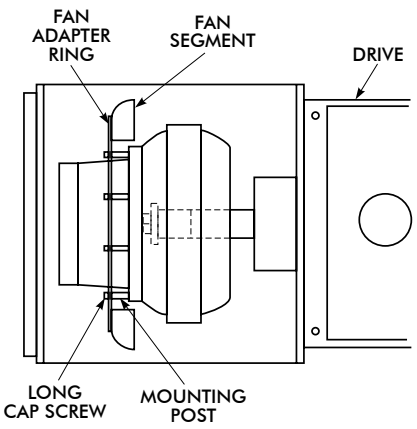
TABLE 1 — Tightening Torques

DRIVE SIZE	Bolt Size	Tightening Torque	
		N-m	lb-ft
M1160	M24	535	725
M1170	M30	1450	1070
M1180	M30	1450	1070
M1190	M36	2530	1866
M1200	M36	2530	1866
M1210	M36	2530	1866

Fluid Coupling

Location of the fluid coupling on the high speed shaft of the drive is determined by the provided shaft spacer. Install the fluid coupling on the high-speed shaft of the gear drive per fluid coupling instructions. If a shaft fan is required, remove every other of the twelve delay fill chamber fasteners. Install the fan adapter ring to the fluid coupling using the long socket head cap screws provided. Place a mounting post between the delay fill chamber flange and the adapter ring as shown in Figure 1. After all fasteners and mounting posts are installed, tighten cap screws to the torque specified in Table 2. Install the six fan segments to the outer bolt circle of the adapter ring, see Table 2 for tightening torque.

FIGURE 1



Once the fluid coupling is installed, the motor adapter plate can be mounted to the bell housing, also being located by a register. Measurements must be taken to accurately position the motor half of the coupling hub on the motor shaft. First, measure the distance from the motor mounting face to the end of the motor shaft, (A). Then measure the distance from the motor adapter plate face to the hub on the fluid coupling, (B). Finally measure the distance from the hub flange to the hub end, (C). The desired gap can be found in Table 3, based on coupling size.

TABLE 2 — Fan Mounting Tightening Torques

Fastener Location	Fastener Size	Tightening Torque	
		Nm	ft-lb
1420HFDD	M12	80	59
1480HFDD	M12	80	59
1584HFDD	M14	130	96
Fan Segment	M8	20	15
Fan Hub ‡	M6	10	7.5

‡ For close coupling only.

TABLE 3 — Coupling Gap

FLUID COUPLING SIZE	Tschan Hub Size	Gap	
		mm	Inch
1420HFDD	230	7.5	0.295
1480HFDD	260	7.5	0.295
1584HFDD	300	8.4	0.331
1660HFDD	360	9.0	0.354

Calculate the hub protrusion:

Protrusion = (A + Gap) – (B + C)

If the calculated protrusion is a negative value, the hub overhangs the shaft by that amount. (Figure 2)

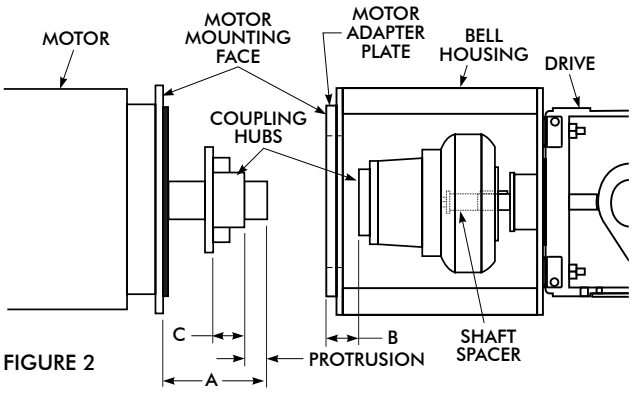


FIGURE 2

Once the hub is correctly located on the motor shaft, the motor can be mounted to the motor adapter plate. The hubs will be aligned and come together to the proper gap. To fill the fluid coupling to the proper oil level, align the mark on the perimeter of the fluid coupling with the mark in the center of the inspection window on the bell housing on the side opposite the TA Bushing nut or shaft extension. To locate the correct mark on the fluid coupling, begin by aligning the fill hole of the fluid coupling with the mark in the inspection window. For fill angles less than 90°, rotate the fill plug upward until the marks line up. For fill angles greater than 90°, rotate the fill plug downward until the marks line up. When the proper marks are in-line, fill the fluid coupling with recommended fluid until fluid appears at the lip of the fill hole.

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Close Coupling

If the drive requires a shaft fan, mount the fan hub on the high-speed shaft of the gear drive, see Figure 3. See Table 4 for shaft protrusion based on drive size. Apply Loctite 242 or equivalent to hub setscrews and tighten into hub. Mount the fan adapter ring to the fan hub. Install six fan segments to the outer bolt circle on the adapter ring to complete the fan, see Table 2 for fastener tightening torque.

FIGURE 3

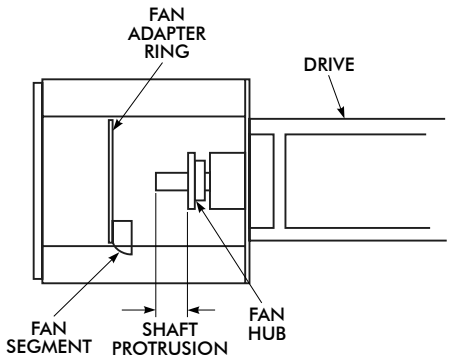

TABLE 4 — Fan Hub Location

DRIVE SIZE	Shaft Protrusion	
	mm	Inch
M1160	110	4.33
M1170	115	4.53
M1180	125	4.92
M1190	130	5.12
M1200	178	7.01
M1210	178	7.01

Mount the motor to the motor adapter plate on the bell housing before installing the coupling. Once the motor is secured, measure the distance (D) between the end of the motor shaft and the high speed shaft of the drive, see Figure 4. Subtract the distance (D) from the length of the spacer coupling (BE). Then divide this value in half to find the overhang of each hub. [Overhang + (BE – D)/2] The overhang will be negative, this is the amount each hub overhangs the shaft. Once the overhang is determined, install the hubs according to the instructions provided with the coupling. Install the spacer sections and verify the gap is correct. If not, readjust the hub on the motor shaft. If the coupling is furnished with an interference fit, readjustment will not be possible, take extra care in making measurements. After the proper gap is set, finish installing the coupling per the instructions.

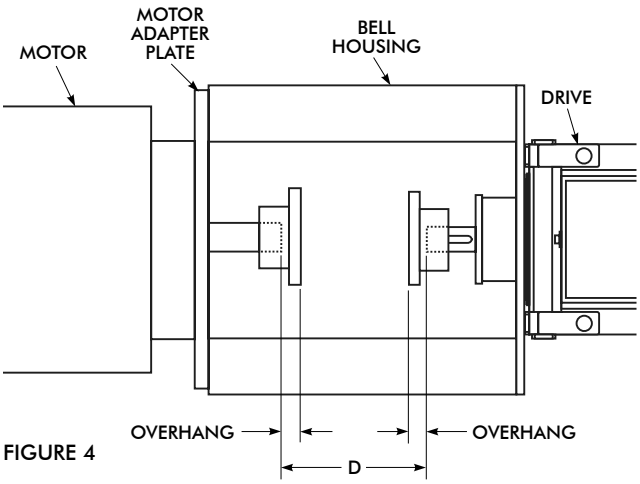

FIGURE 4

Lifting the Alignment Free Drive

Lifting points are provided on the corners of the motor side of the bell housing. Lift by these and the provisions provided on the drive housing itself to maneuver the drive. DO NOT lift by the motor lifting eye.

Alignment Free Assembly and Installation - Cast Design

Introduction

The Alignment Free Drive design consists of a shaft mounted gear drive, bell housing, motor and coupling. When assembled, the gear drive, bell housing and motor locate off registers, resulting in alignment of the shafts. Therefore, no additional alignment is required for the high-speed coupling.

Assembly Instructions

The Bell Housing is fastened to the gear drive's high-speed end using capscrews through the four mounting holes on that face with a nut and lock washer, (see Table 1 for size and torque). Apply Loctite® #242 or equivalent to mounting fastener threads. The bell housing will locate on the bevel head of the gear drive. Read instructions provided with high speed coupling prior to assembly.

TABLE 1 — Tightening Torques

DRIVE SIZE	Bolt Size	Tightening Torque	
		Nm	lb-ft
M1160	M24	780	570
M1170	M30	1540	1140
M1180	M30	1540	1140
M1190	M36	2720	2000
M1200	M36	2720	2000
M1210	M36	2720	2000

High Speed Shaft Fan

High speed shaft fan is standard on all Drive One Alignment Free Drives. Fan size and position is dependent on bell housing casting and high speed coupling, not drive size. Assemble fan to fan hub, apply Loctite #242 or equivalent to fastener threads and tighten.

CAUTION: Do not over-tighten fasteners into plastic fan as fan may crack.

Mount the fan hub on the gear drive high speed shaft such that the set screw hole in the hub is towards the end of the shaft. Locate the hub axially at the values listed in Table 2.

TABLE 2 — Fan Hub Location

DRIVE SIZE	Bell Housing Casting Number *	Hub Location	
		mm	Inch
1420	D011723	130	5.12
1480	D011724	125	4.92
1584	D011725	115	4.53
1660	D011726	142	5.59
Close Coupling	D011723	130	5.12
Close Coupling	D011725	115	4.53

✱ Casting number located on inside sidewall of bell housing.

Dimensions listed are from the inside face of the bell housing to the far side of the hub, see Figure 1. Apply Loctite #242 or equivalent to threads of the set screw and tighten over key to secure hub in position. Fan hub must be installed prior to installing high speed coupling hub.

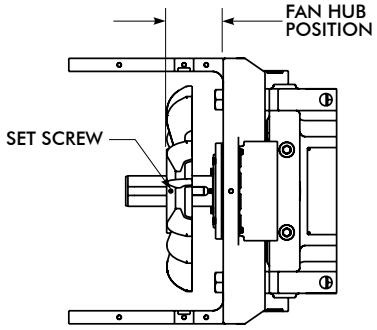

FIGURE 1

Assemble fan shroud mounting rails to bell housing. Assemble fan cowling with expanded metal guard to back of fan shroud/ plates on same fasteners. Mount fan shroud assembly to mounting rails. The cowling may require to be notched to allow clearance for the bell housing to drive mounting fasteners. Rotate fan to ensure clearance, reposition fan hub if necessary. Split fan guard may be removed or installed without disrupting high speed coupling. See Figure 2.

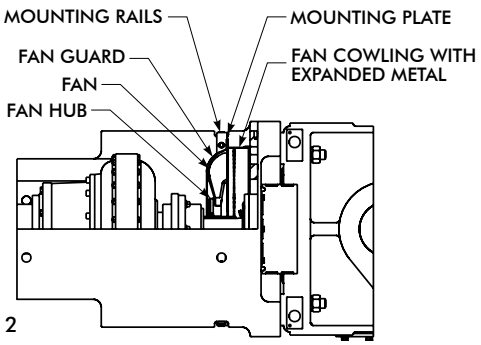

FIGURE 2

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Fluid Coupling:

The fluid coupling can be installed/removed without removing the motor, (see fluid coupling instructions for procedure). Mount the coupling hubs to the drive high speed shaft and the motor shaft. Hubs are to be mounted flush with the end of the shafts (coupling hubs may be furnished with an interference fit). Mount the motor to the bell housing, apply Loctite #242 or equivalent fastener threads and tighten to proper torque. Install fluid coupling per coupling instructions.

To fill the fluid coupling to the proper oil level, install the small top cover on the bell housing. Rotate the fluid coupling such that the fill hole is up and fill with the approximate quantity of oil (see coupling instructions for oil type and quantity). Rotate the coupling in either direction to align the mark on the perimeter of the fluid coupling with the mark in the center of the cover on the bell housing. A container should be placed to catch any excess oil that may spill from the fill hole. If oil drains from the fill hole, allow all excess to drain to achieve the proper fill level. If no oil drains when marks are aligned, rotate coupling back and add more oil. Repeat process until excess oil drains and proper fill level is achieved.

Close Coupling:

Mount the coupling hubs to the drive high speed shaft and motor shaft. Hubs are to be mounted flush with the end of the shafts unless otherwise noted (coupling hubs may be furnished with an interference fit). Mount the motor to the bell housing, apply Loctite #242 or equivalent to fastener threads and tighten to proper torque. Install high speed coupling per coupling instructions.

Guards and Covers:

Install bell housing covers, (top and bottom). Install air deflectors on the top, bottom and both sides of the gear drive. The bends of the deflectors are perforated to allow positioning of the deflectors. Air deflectors should be positioned approximately 25mm [1 inch] from the nearest housing surface by bending deflector towards or away from the drive.

Lifting the Alignment Free Drive

Lifting points are provided on the corners of the motor end of the bell housing. Lift by these and the provisions provided on the drive housing itself to maneuver the drive. DO NOT lift by the motor lifting eye.