

HOW TO USE THIS MANUAL

This manual provides detailed instructions on installation and maintenance of parallel shaft Type VP and right angle Type VR gear 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 GEAR DRIVE.

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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.

NAMEPLATE — Operate Falk 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.

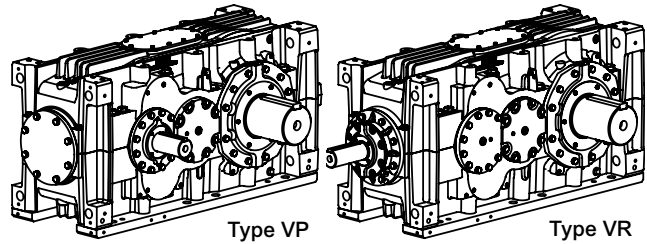
LUBE PLATE — Refer to gear drive lube plate for basic lubrication specifications. Lube plate will be mounted on the drive near the nameplate.

DISASSEMBLY AND ASSEMBLY — Disassembly and 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.

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 Falk V-Class 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 Type VP & VR 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 accessories may require removal of components to access lifting provisions and install 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 VP & VR are with the input and output shafts horizontal.

Allowable mounting angles for standard oil levels are:

	Bridge	Slope
VP & VR	± 2°	± 4°

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.

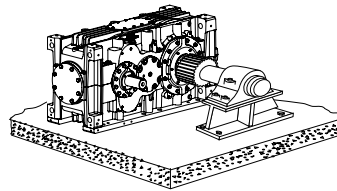
INVERTING DRIVE — Standard VP and VR drives are equipped with lubrication provisions for horizontal mounting with feet down (or Falk emblem up for drives without feet). If the drive was ordered with the "Flip-ability" package, the drive can be mounted in either orientation. To flip VP drives without the "Flip-ability" package, the drive must be disassembled to change hand of the shafting. Removal of the top cover of housing must be performed by Falk RENEW® Prager® in order to ensure that the original warranty is valid. Please contact Falk RENEW Prager for

lead time and pricing. To flip VR drives without the “Flip-ability” package, remove the inspection cover and remove the high-speed and low-speed oil collectors. Remove the opposite inspection cover and reinstall the collectors in the same orientation with respect to the gearing. Apply Loctite® 242 or equivalent to the fasteners. Reinstall inspection covers (top and bottom) with gasket.

For all drives, when flipping, the dipstick and breather (if equipped) must be repositioned to the desired “top” of drive. The dipstick must be located in the hole opposite the low-speed gear. The square head magnetic drain plugs must be repositioned to the desired “bottom” of drive. When flipping a drive that was ordered with the flipability option and accessories, it will be necessary to remove and re-install any accessories in the new orientation.

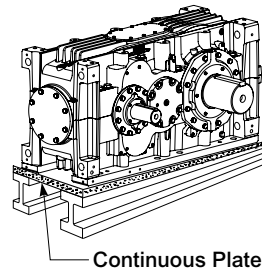
FOUNDATION, GENERAL —

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.



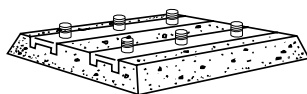
FOUNDATION, STEEL —

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, and 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 drive as illustrated.



FOUNDATION, CONCRETE —

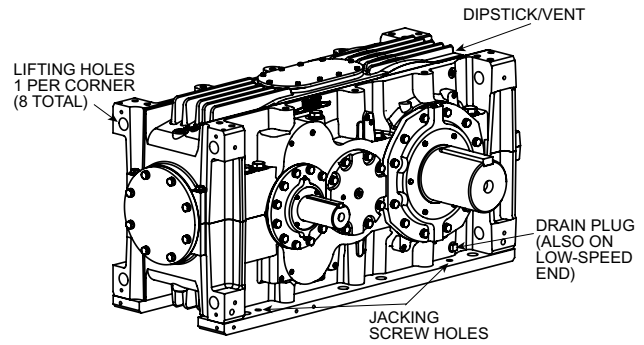
If a concrete foundation is used, allow the concrete to set firmly before bolting down the gear drive. For the best type of mounting, grout structural steel mounting pads into the mounting base, as illustrated, rather than grouting the drive directly into the concrete.



Motors and other components mounted on motor plates or motor brackets may become misaligned during shipment. ALWAYS check alignment after installation. Refer to Page 6 for coupling alignment instructions.

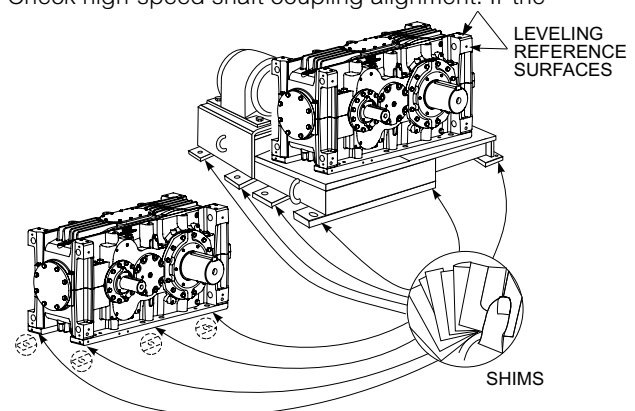
GEAR DRIVE ALIGNMENT

FOOT-MOUNTED DRIVES — Align drive with driven equipment by placing broad, flat shims under feet at all foundation fastener locations. Jack screw holes are provided by mounting feet to facilitate alignment. See Table 5 for fastener and wrench sizes. 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. Refer to Page 6 for coupling alignment.

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. Reshim bedplate and recheck high-speed coupling alignment. If necessary, realign motor.

SHAFT-MOUNTED DRIVES — GENERAL

Shaft-mounted drives should never be mounted in a manner that restricts the natural movement of the drive. They must be allowed to move freely with the shaft on which it is mounted. Shaft-mounted drives should always be used in conjunction with a torque reaction arm. Refer to appendix A for torque reaction arm mounting instructions and angular limits. The drive may require repositioning on the driven shaft after initial installation to accommodate the location of the foundation anchor and be within limits specified in appendix A (rod end adjustable torque arm).

The tapered bore hollow shaft is designed for use with a TA Taper® bushing for mounting the drive on a driven shaft with a straight outside diameter. The taper bushing assembly is supplied with a thrust plate kit and retention fastener as standard (usage is required) shaft cover must be removed to install thrust plate kit. Refer to data sheet supplied with the tapered bushing assembly for driven

shaft length, shaft keyway length and driven shaft tapped hole dimensions for thrust plate retention fastener

Prior to installing the drive, it is a good idea to check the driven shaft for proper dimensions. Using Table 1 or 1A, find the driven shaft size for the application. Verify that dimensions A and B are within the allowable range. When dimensions are verified, proceed with the installation. The minimum and maximum driven shaft engagements, dimension N in Figures 1, are shown in Table 2. The minimum engagement is necessary for full bushing engagement, and the maximum (and specified) engagement is provided for use when the thrust plate kit is used for added retention capacity and an auxiliary removal aid (bushing nut normally used for both).

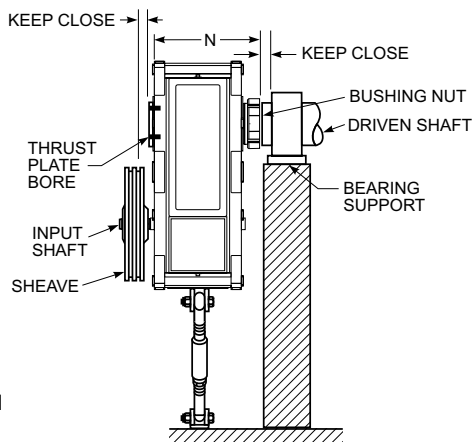


Figure 1

TABLE 1 — Driven Shaft Dimensions — Millimeters

Drive Size	Shaft Diameter Tolerance h10			A		B	
	Nom.	+	-	Min	Max	Min	Max
M107	90	0.0	0.140	99.314	99.774	89.860	90.000
	85	0.0	0.140	96.814	97.274	84.860	85.000
	80	0.0	0.120	94.334	94.774	79.880	80.000
	75	0.0	0.120	91.834	92.274	74.880	75.000
M117	100	0.0	0.140	114.362	114.812	99.860	100.000
	95	0.0	0.140	111.862	112.312	94.860	95.000
	90	0.0	0.140	96.550	97.000	89.860	90.000
M127	120	0.0	0.140	134.334	134.784	119.860	120.000
	115	0.0	0.140	131.834	132.284	114.860	115.000
	110	0.0	0.140	129.334	129.784	109.860	110.000
M133	135	0.0	0.160	146.674	147.264	134.840	135.000
	130	0.0	0.160	144.314	144.784	129.840	130.000
M137	125	0.0	0.160	141.814	142.284	124.840	125.000
	120	0.0	0.160	139.334	139.784	119.860	120.000
M143	150	0.0	0.160	164.193	164.773	149.840	150.000
	140	0.0	0.160	159.193	159.773	139.840	140.000
M145	140	0.0	0.160	159.193	159.773	139.840	140.000
	130	0.0	0.160	154.293	154.773	129.840	130.000
M147	130	0.0	0.160	154.293	154.773	129.840	130.000
	130	0.0	0.160	154.293	154.773	129.840	130.000
M153	170	0.0	0.160	184.173	184.763	169.840	170.000
	160	0.0	0.160	179.113	179.733	159.840	160.000
	150	0.0	0.160	174.113	174.733	149.840	150.000
M155	185	0.0	0.185	201.698	202.303	184.815	185.000
	175	0.0	0.160	196.720	197.303	174.840	175.000
	170	0.0	0.160	194.223	194.803	169.840	170.000
M163	170	0.0	0.160	194.223	194.803	169.840	170.000
	160	0.0	0.160	189.223	189.803	159.840	160.000
M165	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
M167	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
M173	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
M175	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
M177	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000
M187	200	0.0	0.185	226.087	226.732	199.815	200.000
	190	0.0	0.185	221.087	221.732	189.815	190.000

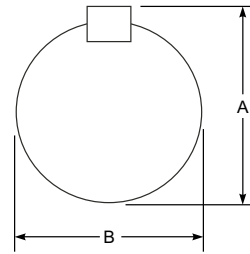


TABLE 1A — Driven Shaft Dimensions — Inches

Drive Size	Shaft Diameter AGMA 6109			A		B	
	Nominal	+	-	Min	Max	Min	Max
M107	3.4375	0.0	0.006	3.8580	3.8770	3.4315	3.4375
	3.1875	0.0	0.006	3.7331	3.7521	3.1815	3.1875
	2.9375	0.0	0.006	3.6081	3.6271	2.9315	2.9375
M117	4.1875	0.0	0.007	4.6278	4.6478	4.1805	4.1875
	3.9375	0.0	0.006	4.5028	4.5218	3.9315	3.9375
	3.4375	0.0	0.006	4.2528	4.2718	3.4315	3.4375
M127	4.4375	0.0	0.007	5.1450	5.1650	4.4305	4.4375
	4.1875	0.0	0.007	5.0200	5.0400	4.1805	4.1875
	3.9375	0.0	0.006	4.8950	4.9140	3.9315	3.9375
M133	4.9375	0.0	0.007	5.5920	5.6120	4.9305	4.9375
	4.4375	0.0	0.007	5.3420	5.3620	4.4305	4.4375
M143	5.9375	0.0	0.007	6.4855	6.5055	5.9305	5.9375
	5.4375	0.0	0.007	6.2349	6.2549	5.4305	5.4375
M145	5.4375	0.0	0.007	6.2349	6.2549	5.4305	5.4375
	4.9375	0.0	0.007	5.9856	6.0056	4.9305	4.9375
M153	6.5000	0.0	0.008	7.1590	7.1800	6.4920	6.5000
	6.0000	0.0	0.007	6.9106	6.9306	5.9930	6.0000
M155	6.0000	0.0	0.007	6.9106	6.9306	5.9930	6.0000
	5.9375	0.0	0.007	6.8794	6.8994	5.9305	5.9375
M163	7.0000	0.0	0.008	7.8045	7.8255	6.9920	7.0000
	6.9375	0.0	0.008	7.7725	7.7935	6.9295	6.9375
M165	6.5000	0.0	0.008	7.5539	7.5749	6.4920	6.5000
	6.0000	0.0	0.007	7.3055	7.3255	5.9930	6.0000
M167	6.0000	0.0	0.007	7.3055	7.3255	5.9930	6.0000
	5.9375	0.0	0.007	7.2743	7.2943	5.9305	5.9375
M173	8.0000	0.0	0.008	9.2224	9.2434	7.9920	8.0000
	7.5000	0.0	0.008	8.8478	8.8688	7.4920	7.5000
M175	8.0000	0.0	0.008	9.2224	9.2434	7.9920	8.0000
	7.5000	0.0	0.008	8.8478	8.8688	7.4920	7.5000
M177	8.0000	0.0	0.008	9.2224	9.2434	7.9920	8.0000
	7.5000	0.0	0.008	8.8478	8.8688	7.4920	7.5000
M187	8.0000	0.0	0.008	9.2224	9.2434	7.9920	8.0000
	7.5000	0.0	0.008	8.8478	8.8688	7.4920	7.5000

TABLE 2 — N Dimension †

Drive Size	Minimum mm (inches)	Maximum mm (inches)
M107	285 (11.2)	340 (13.4)
M117	300 (11.8)	390 (15.4)
M127	310 (12.2)	410 (15.7)
M133, M137	330 (13.0)	450 (17.7)
M143, M145, M147	340 (13.4)	435 (17.1)
M153, M155, M157	380 (15.0)	515 (20.3)
M163, M165, M167	395 (15.6)	545 (21.5)
M173, M175, M177	423 (16.78)	425 (16.84)
M187	423 (16.78)	425 (16.84)

† The minimum engagement is necessary for full bushing engagement; the maximum engagement is only if a thrust plate will be employed to remove the drive from the driven shaft. Shaft engagements include 5 mm (.20 inch) clearance at the bushing nut.

TAPER BUSHING — With the driven shaft keyway at the 12 o'clock position, slide bushing assembly onto the driven shaft, nut end first, and position the keyway slot over the shaft keyway. The bushing may have to be opened slightly to assist in installation. Insert a prybar into the slot in the bushing and very lightly pry open until the bushing

slides onto the shaft. Insert the drive key furnished with the bushing into the shaft keyway. On drives using the thrust plate kit, slide the bushing assembly onto the driven shaft until final position (end of driven shaft open-ended keyway).

INSTALLATION OF SHAFT-MOUNTED DRIVES — TA BUSHING TYPE, SIZES M107 – M167

1. Remove the hollow low-speed shaft cover. Before lifting the drive into position, rotate the high-speed shaft until the hollow shaft keyway will be in position to line up with the driven shaft key.
2. Lift the drive into position and slide onto the driven shaft, taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force.
3. Thread the bushing nut onto the hollow shaft one to two turns. **NOTE:** The bushing nut threads have been coated with an anti-seize compound at the Factory. This compound should not be removed. Before re-installing a previously used nut, recoat the nut threads only with an anti-seize compound.

WARNING: DO NOT apply anti-seize or lubricant to bushing or shaft surfaces. Use of anti-seize may prevent secure connection of the drive to the shaft and cause the drive to move

See Table 9 for nut setscrew and wrench sizes.

- a. **Preferred Method** — Use a spanner, chain or pipe wrench to tighten the bushing nut to the torque value indicated in Table 3. If the required torque cannot be measured, an approximation can be made using Table 3A. The full weight should be applied to the wrench handle in a horizontal position. For example, to achieve the required tightening torque for an M163 bushing nut, an 85 kg person would have to apply all of his/her weight to a wrench handle 1070 mm from the nut (a 190 lb. person would have to apply all his/her weight to a wrench handle 3.5 feet from the nut). Apply Loctite 243 or equivalent to threads of the setscrew. Tighten the setscrew to 10 Nm (90 lb-in). For drives subjected to vibratory conditions, refer to step c.

TABLE 3 — Wrench Type and Bushing Nut Tightening Torque

Drive Size	Wrenches		Nut Tightening Torque Nm (lb-ft)
	GearWrench	Williams	
M107	81858	474B	380 (280)
M117	81858	474B	450 (332)
M127	81858	474B	450 (332)
	Ridgid Tool	Williams	
M133, M137	92685 ★	CT-15 ★	520 (384)
M143, M145, M147	92685 ★	CT-15 ★	630 (465)
M153, M155, M157	92685 ★	CT-15 ★	770 (568)
M163, M165, M167	92685 ★	CT-15 ★	900 (664)

★ These are chain wrenches where standard spanner wrenches are not available.

TABLE 3A — Equivalent Tightening Torque †

Drive Size	Required Torque	Person's Weight	Length of Handle
	Nm (lb-ft)	kg (lbs)	mm (ft)
M107	380 (280)	80-100 (180-220)	460-610 (1.5-2)
M117	450 (332)	80-100 (180-220)	610-915 (2-3)
M127	450 (332)	80-100 (180-220)	610-915 (2-3)
M133, M137	520 (384)	80-100 (180-220)	610-915 (2-3)
M143, M145, M147	630 (465)	80-100 (180-220)	915-1220 (3-4)
M153, M155, M157	770 (568)	80-100 (180-220)	915-1220 (3-4)
M163, M165, M167	900 (664)	80-100 (180-220)	1220-1525 (4-5)

† If a torque wrench is not available, the torque can be approximated by applying the given weight at the given distance from the nut.

- b. **Optional TA Bushing Nut Tightening** — When the required tightening torque of the TA bushing nut cannot be measured at the low-speed shaft, the torque-multiplying characteristic of the drive can be utilized. Rotating the high-speed shaft of the drive while holding the TA bushing nut stationary will allow a large torque to be reached. Fix the TA bushing nut by securing a spanner, chain or pipe wrench to the nut. Allow the wrench to contact a surface that will hold the force when tightening.

WARNING: Make sure the wrench will not slip and cause damage or injury.

Determine the proper rotation of the high-speed shaft to achieve tightening of the stationary nut. If the drive is equipped with a backstop, verify that the backstop will allow the necessary rotation or remove the backstop. Find the torque to apply to the high-speed shaft by dividing the tightening torque indicated in Table 3 by the drive's ratio (torque ÷ ratio). Apply the calculated torque to the high-speed shaft or coupling using a spanner, chain or pipe wrench. Be careful not to damage the usable length of the high-speed shaft. Remove the fixed wrench from the TA Bushing nut and reassemble the backstop if necessary.

WARNING: Never use the prime mover to produce the required torque. This could result in severe personal injury or damage.

Apply Loctite 243 or equivalent to threads of setscrew. Tighten the setscrew to 10 Nm (90 lb-in) on the bushing nut. For drives subjected to vibratory conditions, refer to step c.

- c. **Drives Subjected to Vibratory Conditions** — Extra precautions should be taken for drives subjected to vibratory conditions. With the nut of the TA bushing tightened to the specified torque, locate the setscrew hole in the nut of the bushing assembly. Using a 6 mm (15/64 inch) diameter drill, create a dimple in the outside diameter of the bushing flange by drilling through the setscrew hole in the nut. Apply Loctite 243 or equivalent to threads of setscrew and tighten into bushing nut.

4. **Thrust Plate Installation** — Install thrust plate and thrust plate retaining ring in hollow shaft. Coat four to five engaging threads of retention fastener with Loctite 242 or equivalent (medium strength) thread locking compound and thread into driven shaft end. Tighten fastener to 80% of torque shown in Table 4 or 4A. Reinstall shaft cover.

**REMOVAL OF SHAFT-MOUNTED DRIVES —
TA BUSHING TYPE, SIZES M107 – M167**

WARNING: Lock out power source and remove all external loads from drive before servicing drive or accessories.

1. Drain the lubricant from the drive.
2. Remove safety guards and belts (if so equipped). Remove hollow shaft cover opposite bushing nut.
3. Remove motor and motor mount (if so equipped).
4. Remove backstop (if so equipped).

WARNING: Drive must be supported during removal process. Use a sling and take up the slack before proceeding.

5. Remove the setscrew(s) on the bushing nut which is located at the output end of the hollow shaft. Remove the driven shaft retention fastener from the thrust plate.
6. Use a spanner, pipe or chain wrench to loosen the bushing nut. Initially the nut will freely rotate counterclockwise approximately 180° as the nut moves from the locked position to the removal position. At this point, anticipate resistance which indicates unseating of the bushing. Continue to rotate the nut until it is free from the hollow shaft. If unable to release the drive from the driven shaft with the bushing nut, the thrust plate kit using a backing bolt (threaded into the driven shaft tapped hole) and removal bolt (threaded into the thrust plate tapped hole) may be used to release the drive from the driven shaft. Refer to Appendix E for backing and removal bolt sizes (user supplied). To use, remove thrust plate retaining ring and thrust plate, install backing bolt, and reinstall thrust plate with retaining ring. Remove bushing nut retaining ring. Install removal bolt in thrust plate and tighten against backing bolt to release drive from driven shaft (insert key stock or similar tool in thrust plate key slot to engage hollow shaft keyway to prevent thrust plate rotation while tightening removal bolt).
7. Prepare drive for lifting by disconnecting the torque arm.
8. Slide the drive from the bushing. The bushing can be left in place or removed as required. If bushing will not slide off the shaft, insert a small prybar into the split of the bushing and pry the split open slightly to loosen the bushing and remove from the shaft.

TAPER BUSHING — SIZES M173 – M187

Driven shafts are retained on sizes M173 thru M187 drives with a thrust plate and three cap screw arrangement. With the driven shaft keyway at the 12 o'clock position, slide bushing onto the driven shaft, flange end first, and position the keyway slot over the shaft keyway. The bushing may have to be opened slightly to assist in installation. Insert a prybar into the slot in the bushing and very lightly pry open until the bushing slides onto the shaft. Insert the drive key furnished with the bushing into the shaft keyway.

**INSTALLATION OF SHAFT-MOUNTED
DRIVES SIZES M173 – M187**

1. Before lifting the drive into position, rotate the high-speed shaft until the hollow shaft keyway will be in position to line-up with the driven shaft key.

2. Lift the drive into position and slide onto the drive shaft, taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force.
3. Align three holes in hollow shaft thrust plate with tapped holes in end of driven shaft. Coat four to five engaging threads of retention fasteners with Loctite #222 or equivalent (low strength) thread locking compound. Insert fasteners through thrust plate and engage tapped holes in driven shaft one to two turns by hand to ensure that fasteners are not cross-threaded.
4. Tighten fasteners to the torque values ($\pm 10\%$) listed below:
M24 x 3 – 640 Nm (470 lb-ft) for metric-based bushing bores.
1.250-7UNC – 1400 Nm (1060 lb-ft) for inch-based bushing bores.
5. Re-install low-speed shaft cover.

**REMOVAL OF SHAFT-MOUNTED DRIVES
SIZES M173 – M187**

1. Remove low-speed shaft cover.
2. Remove three thrust plate fasteners, retaining ring and thrust plate from the hollow shaft.
3. Select the backing bolts from Appendix E and install them into the three threaded holes in the end of the driven shaft. The head of the backing bolts provides a working surface for the removal bolts.
4. Re-insert the thrust plate and retaining ring into the hollow shaft and select the removal bolts from Appendix E.
5. Thread three removal bolts into the thrust plate until they contact the backing bolt heads.
6. Tighten the removal bolts equally in stages to the torque indicated in Appendix E, after torquing the bolts, as instructed, strike the bolts sharply with a hammer and re-torque the bolts if separation of the drive from the driven shaft did not occur. Repeat this procedure, re-torquing the bolts after each blow, until separation occurs.
7. Prepare drive for lifting by disconnecting the torque arm.
8. Slide the drive from the bushing. The bushing can be left in place or removed as required. If bushing will not slide off the shaft, insert a small prybar into the split of the bushing and pry the split open slightly to loosen the bushing and remove from the shaft.

**SHAFT-MOUNTED DRIVE — SHRINK DISC
SIZES M127 – M227**

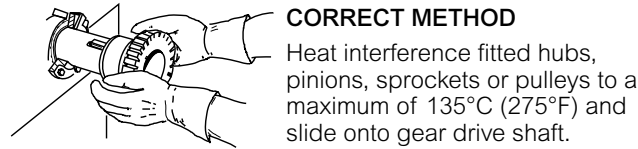
For installation and removal of shaft mounted drives with a Shrink Disc connection, refer to Manual 168-850 (Shrink Disc Installation and Maintenance Instructions).

SHAFT CONNECTIONS

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

COUPLING CONNECTIONS —

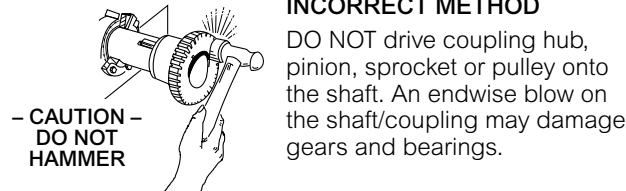
The performance and life of any coupling depends largely upon how well the coupling is installed and serviced. Refer to the coupling manufacturer's manual for specific instructions.



CORRECT METHOD

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

See manual 138-050 for proper location.



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.

— CAUTION —
DO NOT
HAMMER

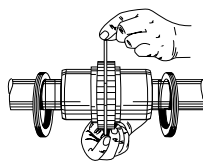
FALK COUPLINGS — (except fluid type) Detailed installation manuals are available from Factory, your local Rexnord representative or distributor—just provide size and type designations stamped on the coupling. For lubricant requirements and a list of typical lubricants meeting Rexnord specifications,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

FALK FLANGED-TYPE RIGID COUPLINGS — For installation and removal of shaft mounted drives with a Falk flanged-type rigid coupling connection, refer to the 3000 series MCF installation and maintenance manual (GR3-020) or the 2000 series MCF installation and maintenance manual (458-864).

FALK FLUID COUPLINGS — Refer to the installation manual furnished with the Falk fluid coupling for installation and startup instructions. For Alignment-Free Drives, refer to Appendix C.

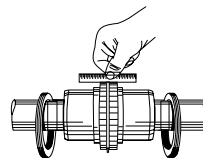
GAP AND ANGULAR ALIGNMENT —

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.



Stefflex Illustrated

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

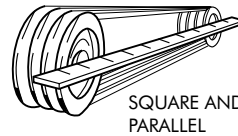
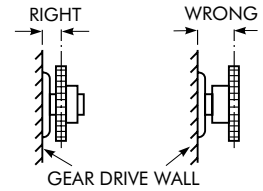


Stefflex Illustrated

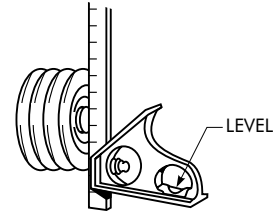
SPROCKETS, PULLEYS OR SHEAVES — Mount power take-offs as close to the gear drive housing as possible to avoid undue bearing load and shaft deflection.

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.



SQUARE AND PARALLEL



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 belt periodically; tighten the belts if they are slipping.

TABLE 4 — Tightening Torques: ± 5%
DO NOT Lubricate Fasteners

Fastener Size	Metric Fasteners – Property Class 8.8			
	Metal to Metal		Metal to Concrete	
	Nm	lb-ft	Nm	lb-ft
M4 x .7	3	2	2	1.5
M5 x .8	6	5	5	3.5
M6 x 1.0	10	8	8	6
M8 x 1.25	24	18	19	14
M10 x 1.5	50	36	39	29
M12 x 1.75	84	62	68	50
M16 x 2	210	156	170	126
M20 x 2.5	415	305	330	246
M24 x 3	705	530	570	420
M30 x 3.5	1440	1060	1150	850
M36 x 4	2520	1860	2030	1500
M42 x 4.5	4050	3000	3250	2400
M48 x 5	6100	4500	4880	3600
M56 x 5.5	9850	7300	7860	5800

TABLE 4A — Tightening Torques: ± 5%
DO NOT Lubricate Fasteners

Fastener Size	Inch Fasteners – Grade 5			
	Metal to Metal		Metal to Concrete	
	Nm	lb-ft	Nm	lb-ft
.250-20	10	7	8	6
.3125-18	21	15	16	12
.375-16	37	27	30	22
.500-13	91	67	73	54
.625-11	184	134	146	108
.750-10	330	242	265	194
.875-9	530	395	425	315
1.000-8	800	590	640	475
1.125-7	1000	740	800	590
1.250-7	1420	1060	1140	840
1.375-6	1860	1360	1480	1100
1.500-6	2480	1840	1980	1460
1.750-5	5300	3900	4240	2700
2.000-4.5	7900	5900	6300	4100
2.250-4.5	11800	8600	9400	6000
2.500-4	16000	11800	12800	8300
2.750-4	19800	14600	15800	10200
3.000-4	26400	19400	21100	13600

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. Accurate alignment is required to avoid inducing loads on drive bearings due to misalignment. 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.

FASTENER TIGHTENING TORQUES

Use the tightening torque values specified in Table 4 and 4A for fastening Falk gear drives, motors and accessories to their mounting surfaces with un-lubricated fasteners. DO NOT use these values for "torque locking" fasteners or for fastening components with aluminum feet, soft gaskets, or vibration dampeners on the mounting surface. If the tightening torque exceeds the capacity of the torque wrench, use a torque multiplier. Use ISO property class 8.8 for metric fasteners. See Table 5 for fastener and wrench sizes.

FAN COOLING

RADIAL SHAFT FANS — Standard horizontal shaft-type M107–M227 VP drives have radial shaft fans when required for cooling. Radial fans function in either rotation of the drive. The fan is a split design that can be removed without disturbing other equipment or components connected to the shaft. The fan hub is not removable without removing other equipment. If fan hub is removed or repositioned, remove and clean fasteners and setscrew. Apply Loctite #242 threadlocker or equivalent to fasteners, setscrew and tapped setscrew hole in hub before reinstalling. Caution: Do NOT over tighten fasteners securing plastic fan to hub.

AXIAL SHAFT FANS — Standard horizontal shaft type M107–M227 VR and all M237–M277 drives have axial shaft fans when required for cooling. Axial shaft fans are rotation-dependent and will only function in the rotation indicated by arrow. If the opposite rotation is required, the fan must be changed to one of the desired rotation (consult factory for opposite rotation fan). The fan is a split design that can be removed without disturbing other equipment or components connected to the shaft. The fan hub is not removable without removing other equipment; both rotation fans use the same hub. If fan hub is removed or repositioned, remove and clean fasteners and setscrew. Apply Loctite #242 threadlocker or equivalent to fasteners, setscrew and tapped setscrew hole in hub before reinstalling.

Radial and axial shaft fans require unimpeded airflow to operate. Maintain a minimum of 25 mm (1.0") clearance between fan shroud and the closest obstruction (coupling guard, etc.) for optimal performance.

INTEGRAL COOLING

DURAPLATE™ COOLER — Standard horizontal shaft-type VP and VR drives have DuraPlate coolers when required for added thermal capacity. No electricity or external water is required for cooling. The system consists of a radial or axial fan, shaft-driven oil pump and cooling plates. The entire system functions in either rotation of the drive — however, the shaft driven pump may need to be re-oriented when switching rotation directions, depending on manufacture date. See Appendix G: "Changing Rotation Direction with DuraPlate Cooler." Also, some configurations are equipped with an axial fan that must be re-configured for opposite rotation direction (see axial fan section). The M107–M227 VP and all M237–M277 fan and shrouds are a split design that can be removed without disturbing other equipment or components connected to the shaft. The M107–M227 VR fan and shroud are not a split design. If fan hub is removed or repositioned, remove and clean fasteners and setscrew. Apply Loctite #242 threadlocker or equivalent to fasteners, setscrew and tapped setscrew hole in hub before reinstalling. The system is also equipped with a combination pressure relief/thermal bypass valve. Pressure relief limits of the valve are 586 kPa (85 psi) and thermal bypass temperature of 60°C (140°F). See Oil Pump sections under Lubrication and Oil Levels for additional information. Duraplate coolers require unimpeded airflow to operate. Maintain a minimum of 25 mm (1.0") clearance between fan shroud and the closet obstruction (coupling guard, etc.) for optimal performance.

CAUTION: *M107-M227 VR heat exchangers are equipped with a welded pipe jumper between inner and outer plates. Do not use this as a step or handle!*

WATER COOLING

WATER COOLED HEAT EXCHANGERS — Install a shut-off or control valve in the water line to the heat exchanger to regulate the water flow through the exchanger. Also install a water flow gauge between the control valve and the exchanger to determine actual flow rate. Discharge water to an OPEN DRAIN to prevent back pressure.

AIR VENTS

All drives must be equipped with an air vent or expansion chamber for operation. Drives are shipped sealed and require vent/breather installation. The standard vent is integral with the dipstick and is maintenance-free. The drive may be equipped with an optional premium desiccant vent/breather. See Appendix F for installation and maintenance instructions. Other vent/breather/expansion chamber options may also be available. See information included with component.

TABLE 5 — Fastener & Wrench Sizes

Fastener		DRIVE SIZE								
		M107	M117	M127	M133, M137	M143, M145, M147	M153, M155, M157	M163, M165, M167	M173, M175, M177	M187
Bushing Nut	Diameter	185mm 7.3"	205mm 8.1"	225mm 8.9"	240mm 9.4"	260mm 10.2"	280mm 11.0"	295 mm 11.6"
	Circumference	581mm 22.9"	644mm 25.4"	707mm 27.8"	754mm 29.7"	817mm 32.2"	880mm 34.6"	927 mm 36.5"
Bushing Nut Setscrew	Screw Size	M8	M8	M8	M8	M8	M8	M8
	Hex Size	4mm	4mm	4mm	4mm	4mm	4mm	4 mm
Inspection Cover	Screw Size	M6	M6	M8	M8	M8	M8	M8	M8	M8
	Wrench Size	10mm	10mm	13mm	13mm	13mm	13mm	13 mm	13 mm	13 mm
Jackscrews	Screw Size	M16	M16	M12	M20	M20	M20	M20	M24	M24
	Wrench Size	24mm	24mm	19mm	30mm	30mm	36mm	30 mm	36 mm	36 mm
Magnetic Drain Plugs	Plug Size	1.0 NPT / 0.75 NPT	1.0 NPT / 0.75 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT
	Wrench Size (Square)	13/16" / 5/8"	13/16" / 5/8"	13/16"	13/16"	13/16"	13/16"	13/16"	13/16"	13/16"
Other Plugs	Plug Size	1.0 NPT / 0.75 NPT	1.0 NPT / 0.75 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT
	Hex Size	5/8" / 9/16"	5/8" / 9/16"	5/8"	5/8"	5/8"	5/8"	5/8"	5/8"	5/8"
Torque Arm	Nut Size	M30	M30	M39	M39	M39	M39	M39	M45	M45
	Wrench Size	46mm	46mm	60mm	60mm	60mm	60mm	60 mm	70 mm	70 mm
Grease Purge Cover	Screw Size	M5/M6	M5/M6	M6	M6 / M8	M6 / M8	M6 / M8	M6 / M8	M6 / M8	M6 / M8
	Wrench Size	8mm / 10mm	8mm / 10mm	10mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10 mm / 13 mm	10 mm / 13 mm	10 mm / 13 mm
Shaft Fan Shroud	Screw Size	M6/M8/M12	M6/M8/M12	M6/M8/M12	M8 / M12	M8 / M12	M8 / M12	M8 / M12	M8 / M12	M8 / M12
	Wrench Size	10mm/13mm/ 19mm	10mm/13mm/ 19mm	10mm/13mm/ 19mm	13mm / 19mm	13mm / 19mm	13mm / 19mm	13mm / 19mm	13mm / 19mm	13mm / 19mm
Shaft Fan Setscrew	Screw Size	M5/M6/M8	M5/M6/M8	M5/M8	M8 / M10	M8 / M10	M8 / M10	M8 / M10	M8 / M10	M8 / M10
	Hex Size	2.5mm/3mm/4mm	2.5mm/3mm/4mm	2.5mm / 4mm	4 mm / 5 mm	4 mm / 5 mm	4 mm / 5 mm	4 mm / 5 mm	4 mm / 5 mm	4 mm / 5 mm

Fastener		DRIVE SIZE								
		M193 & M197	M203, M205 & M207	M213, M215 & M217	M223, M225 & M227	M237	M243, M247	M253, M257	M263, M267	M273, M277
Inspection Cover	Screw Size	M10	M10	M10	M10	M10	M10	M10	M10	M10
	Wrench Size	17mm	17mm	17mm	17mm	17mm	17mm	17mm	17mm	17mm
Jackscrews	Screw Size	M24	M24	M24	M24	M24	M30	M30	M30	M30
	Wrench Size	36mm	36mm	36mm	36mm	36mm	46mm	46mm	46mm	46mm
Magnetic Drain Plugs	Plug Size	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT	2.0 NPT
	Wrench Size (Sqr)	1-3/8"	1-3/8"	1-3/8"	1-3/8"	1-3/8"	1-3/8"	1-3/8"	1-3/8"	1-3/8"
Other Plugs	Plug Size	1.0 NPT	1.0 NPT	1.0 NPT	1.0 NPT	2.5 NPT	2.5 NPT	2.5 NPT	2.5 NPT	2.5 NPT
	Wrench Size	5/8" Hex Skt	5/8" Hex Skt	5/8" Hex Skt	5/8" Hex Skt	1-1/8" Sqr Skt	1-1/8" Sqr Skt	1-1/8" Sqr Skt	1-1/8" Sqr Skt	1-1/8" Sqr Skt
Grease Purge Cover	Screw Size	M6/M8	M6/M8	M6/M8	M6/M8	M6/M8	M6/M8	M6/M8	M6/M8	M6/M8
	Wrench Size	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm	10mm / 13mm
Shaft Fan Shroud	Screw Size	M8 / M12	M8 / M12	M8 / M12	M8 / M12	M8 / M10 / M16	M8 / M10 / M16	M8 / M10 / M16	M8 / M10 / M16	M8 / M10 / M16
	Wrench Size	13mm / 19mm	13mm / 19mm	13mm / 19mm	13mm / 19mm	13mm/17mm/ 24mm	13mm/17mm/ 24mm	13mm/17mm/ 24mm	13mm/17mm/ 24mm	13mm/17mm/ 24mm
Shaft Fan Setscrew	Screw Size	M8/M10	M8/M10	M8/M10	M8/M10	M8/M10	M10	M10	M12	M12
	Hex Size	4mm / 5mm	4mm / 5mm	4mm / 5mm	4mm / 5mm	4mm / 5mm	5mm	5mm	6mm	6mm

Lubrication Recommendations

INTRODUCTION

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

WARNING: *Drives are shipped without oil.*

Industrial type extreme pressure (EP) or industrial type micropitting resistant gear lubricants **MUST** be used with V-Class gear drives. They can be formulated using petroleum or synthetic base stocks.

The section on food grade lubricants provides guidance selecting lubricants for applications needing this class of lubricants. Food grade lubricants are formulated using petroleum or different types of synthetic base stocks.

LUBRICANT SELECTION PROCESS

1. Refer to Table 7 or Table 8 for proper lubricant viscosity grade based on ambient temperature range.
2. Refer to Table 6 for summary of lubricant type.
3. Using proper lubricant table and viscosity grade, select desired lubricant manufacturer name.
4. Refer to drive nameplate for approximate oil capacity to purchase.

TABLE 6 — Summary of Lubricant Type and Greases

Petroleum-Based	
Extreme Pressure (EP) See Table 9	Micropitting Resistant See Table 9A
Synthetic Lubricant, Polyalphaolefin Type (PAO)	
Extreme Pressure (EP) See Table 10	Micropitting Resistant See Table 10A
Conventional Grease See Table 11	
Food Grade Lubricant & Grease See Page 13	

VISCOSITY (IMPORTANT)

The proper viscosity grade for petroleum-based lubricant is found in Table 7. For synthetic lubricant viscosity grades, refer to Table 8 and the “Synthetic Lubricants” paragraphs.

Viscosity grade is determined by ambient air temperature in immediate vicinity of gear drive. Lubricant selections must have a pour point at least 10°F (5.5°C) below the expected minimum ambient starting temperature. For lower ambient temperatures, immersion heaters may be required to ensure proper lubrication at cold start conditions.

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump (including DuraPlate), cold temperature oil viscosity is very important. Lubricant viscosity at start-up generally should not exceed 3250 cSt (15,000 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.

SUMP HEATERS — For cold starts, the gearbox may be equipped with a sump heater to warm lubricant to acceptable viscosities. Approximate heating time is two to four hours depending on ambient conditions. Standard heaters will raise sump temperature approximately 17°C (30°F) in two hours depending on conditions. For drives equipped with pumps, the minimum temperature of the sump at start is 10°C (50°F) for petroleum-based lubricants and 2°C (35°F) for synthetic lubricants.

LUBRICANT TYPES

PETROLEUM-BASED GEAR LUBRICANTS

(TABLES 9 & 9A) — Industrial type (not automotive) petroleum-based sulfur-phosphorous extreme pressure (EP) or micropitting resistant 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 specific requirements are listed in Tables 9 & 9A. Failure to use an approved lubricant voids warranty.

SYNTHETIC LUBRICANTS (TABLES 10 & 10A) —

Synthetic extreme pressure (EP) or micropitting resistant 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 synthetic lubricants is given in Table 8. An approved lubricant **MUST** be used. Approved synthetic lubricants meeting the specific requirements are listed in Tables 10 & 10A. Failure to use an approved lubricant voids warranty.

EXTREME PRESSURE (EP) LUBRICANTS (TABLES 9 & 10)

— EP lubricants are manufactured from petroleum or synthetic base lubricants. Anti-scuff is another term used to describe EP lubricants.

MICROPITTING RESISTANT LUBRICANTS (TABLES 9A & 10A)

— Micropitting resistant lubricants are specially developed for surface hardened gearing commonly used in modern industrial gear drives. These lubricants contain additives to resist formation of micropitting and other conventional forms of gear wear. Generally lubricants are available in limited number of viscosity grades.

WARNING: LUBRICANTS IN FOOD PROCESSING

INDUSTRY — *Generally conventional gear lubricants are classified as H2 by NSF (National Sanitation Foundation) since they contain harmful substances and should not be used in the food processing industry. Lubricants registered as H1 by NSF are suitable for food processing applications.*

CLIMATE CONDITIONS — Ambient temperature in immediate vicinity of gear drive is very important for determining viscosity grade. Table 7 provides viscosity grade selections for petroleum-based lubricants. See Table 8 for synthetic lubricants.

OIL LEVELS

TYPES VP & VR — Fill gear drive with oil to level indicated on oil dipstick. Prime oil troughs and pans with at least two gallons or full sump capacity (if less than two gallons) of oil when filling. Approximate oil capacities are given on the drive nameplate. Gear drive can be filled through dipstick tube, oil fill plug or inspection cover. Inspection cover must be removed to prime oil troughs. Clean area around fill location BEFORE removing dipstick, plug or cover to reduce risk of debris getting into gear drive. Lubricant 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 a gasket. Gaskets in good condition may be re-used. Replace damaged gaskets.

CAUTION: *If drive has been idle for more than one month, re-prime oil troughs and pans before start-up.*

DRIVES WITH OIL PUMPS — Fill drive to level marked on the dipstick. Before starting the gear drive, rotate the input shaft to check for obstructions. For drives equipped with electric motor-driven oil pumps, run the oil pump for 2 to 5 minutes with the gear drive not running. For all drives, start the gear drive and allow it to run without load for several minutes to fill system components. Verify that the pump is circulating oil properly then shut down drive. Recheck oil level and add oil if necessary. When everything is satisfactory, the drive is ready for operation.

TABLE 7 — Viscosity Grade Recommendations for Petroleum-Based Extreme Pressure (EP) and Micropitting Resistant Lubricants

Ambient Temperature ▲ Range	-9° to +16°C (+15° to +60°F)	+10° to +52°C (+50° to +125°F)
ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5	6

▲ See Viscosity (Important) section on oil pumps.

TABLE 8 — Viscosity Grade Recommendations for Synthetic Extreme Pressure (EP) and Micropitting Resistant Lubricants

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

▲ See Viscosity (Important) section on oil pumps.

LUBRICATION SYSTEMS

SPLASH LUBRICATED DRIVES — Standard horizontal shaft type VP and VR drives are splash lubricated. The lubricant is picked up by the revolving elements and distributed to bearings and gear meshes.

OIL PUMP LUBRICATED DRIVES — Types VP and VR may be equipped with oil pumps for special lubrication considerations or external cooling.

PREVENTIVE MAINTENANCE

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Tighten all external bolts and plugs where necessary. See Table 5 for fastener and wrench sizes. 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:

- Operate drive until sump oil reaches normal operating temperature. Shut down drive and drain immediately. CAUTION: Oil may be hot. Clean up any spilled oil per applicable environmental standards.
- Immediately flush drive (including troughs and pans) 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 25 - 50% of the initial fill volume or until clean oil flows through the drain.
- 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 —

- 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.
- 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.
- If drive is equipped with a fan, periodically clean accumulated foreign debris from the fan, guard, and deflector.
- If drive is equipped with a torque arm, check for free movement.

TABLE 9 — Petroleum Based EP (Extreme Pressure) Lubricants ▲

Maximum Operating Temperature of Lubricants 93°C (200°F)

ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5	6
Viscosity cSt @ 40°C ■	198-242	288-352
Viscosity SSU @ 100°F	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name
Castrol Industrial Lubricants	Alpha SP 220	Alpha SP 320
Chevron / Texaco / Caltex	Meropa 220	Meropa 320
	Meropa XL 220	Meropa XL 320
Citgo Petroleum Corp.	EP Compound 220	EP Compound 320
Exxon Mobil / Esso	Mobilgear 600 XP 220	Mobilgear 600 XP 320
Fuchs Lubricants Company	GearMaster CLP Oils 220	- - -
Petro-Canada Lubricants	Enduratex EP 220	Enduratex EP 320
Phillips 66 / Conoco / 76 Lubricants / Kendall	Extra Duty Gear Oil 220	Extra Duty Gear Oil 320
Shell Oil Co.	Omala S2 G 220	Omala S2 G 320
Total Lubricants USA / Keystone Div. Penwalt Corp.	Carter EP 220	Carter EP 320

▲ Minimum viscosity index of 90.

■ Kinematic viscosity in units of mm²/s is equivalent to cSt (centistokes).

TABLE 9A — Petroleum Based Micropitting Resistant Lubricants ▲

Maximum Operating Temperature of Lubricants 93°C (200°F)

ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5	6
Viscosity cSt @ 40°C ■	198-242	288-352
Viscosity SSU @ 100°F	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name
Kluber Lubrication	Kluberoil GEM 1 N 220	Kluberoil GEM 1 N 320
Chevron / Texaco / Caltex	Meropa XL 220	Meropa XL 320

▲ Minimum viscosity index of 90.

■ Kinematic viscosity in units of mm²/s is equivalent to cSt (centistokes).

TABLE 10 — Synthetic PAO (Polyalphaolefin) EP (Extreme Pressure) Lubricants ▲

ISO Viscosity Grade	150	220	320
AGMA Viscosity Grade	4	5	6
Viscosity cSt @ 40°C ■	135-165	198-242	288-352
Viscosity SSU @ 100°F	626-765	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name	Lubricant Name
Castrol Industrial Lubricants	Alphasyn EP 150	Alphasyn EP 220	Alphasyn EP 320
	Castrol Isolube EP 150	Castrol Isolube EP 220	Castrol Isolube EP 320
Chevron / Texaco / Caltex	Meropa EliteSyn XM 150	Meropa EliteSyn XM 220	Meropa EliteSyn XM 320
Citgo Petroleum Corp.	CITGEAR Synthetic EP Gear 150	CITGEAR Synthetic EP Gear 220	CITGEAR Synthetic EP Gear 320
Exxon Mobil / Esso	Mobil SHC Gear 150	Mobil SHC Gear 220	Mobil SHC Gear 320
Fuchs Lubricants Company	- - -	Renolin Unisyn CLP 220	Renolin Unisyn CLP 320
Kluber Lubrication	Klubersynth EG 4 150	Klubersynth EG 4 220	Klubersynth EG 4 320
Petro-Canada Lubricants	Enduratex Synthetic EP 150	Enduratex Synthetic EP 220	Enduratex Synthetic EP 320
Phillips 66 / Conoco / 76 Lubricants / Kendall	Syncon EP Plus Gear Oil 150	Syncon EP Plus Gear Oil 220	Syncon EP Plus Gear Oil 320
Shell Oil Co.	Omala S4 GX 150	Omala S4 GX 220	Omala S4 GX 320
Whitmore Mfg. Company	Decathlon HD 150	Decathlon HD 220	Decathlon HD 320

▲ Minimum viscosity index of 130. Consult lubricant supplier/manufacturer for maximum operating temperature.

■ Kinematic viscosity in units of mm²/s is equivalent to cSt (centistokes).

TABLE 10A — Synthetic PAO (Polyalphaolefin) Micropitting Resistant Lubricants ▲

ISO Viscosity Grade	150	220	320
AGMA Viscosity Grade	4	5	6
Viscosity cSt @ 40°C ■	135-165	198-242	288-352
Viscosity SSU @ 100°F	626-765	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name	Lubricant Name
Chevron / Texaco / Caltex	Meropa EliteSyn XM 150	Meropa EliteSyn XM 220	Meropa EliteSyn XM 320
Exxon Mobil / Esso	---	---	Mobil SHC Gear 320 WT
Kluber Lubrication	Klubersynth GEM 4 N 150	Klubersynth GEM 4 N 220	Klubersynth GEM 4 N 320
Petro-Canada Lubricants	---	---	Harnex 320
Phillips 66 / Conoco / 76 Lubricants / Kendall	---	---	Syncon WTL 320
Whitmore Manufacturing Company	Decathlon F 150	Decathlon F 220	Decathlon F 320

▲ Minimum viscosity index of 130. Consult lubricant supplier/manufacturer for maximum operating temperature.
 ■ Kinematic viscosity in units of mm²/s is equivalent to cSt (centistokes).

LUBRICANT ANALYSIS AND CHANGES

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

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%.
7. Solid particle contamination code exceeds 25/22/18 for particle sizes ≥4/≥6/≥14 microns, respectively per ISO 4406.

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

PETROLEUM LUBRICANTS (EP AND MICROPITTING RESISTANT) — In the absence of oil analysis, change gear oils 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, lubricants should be changed every 3 to 4 months or 1500 to 2000 hours. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature, refer to Table 7. Lubricant suppliers can test oil from the drive periodically and recommend economical change schedules.

SYNTHETIC LUBRICANTS (EP AND MICROPITTING RESISTANT) — In the absence of oil analysis, synthetic lube change intervals can be extended to 8000 hours depending upon operating temperatures. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Table 8.

GREASE LUBRICATED SEALS AND BEARINGS

All drives and some backstops have grease lubricated seals. Some specially mounted drives have grease lubricated bearings. Drives are shipped with NLGI #2 grade grease in the seal housing cavities and in those bearings requiring grease lubrication unless otherwise specified. Refer to Table 11 for grease recommendations.

GREASE LUBRICATED SEALS — Falk V-Class gear drives are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts into the drive.

Grease seals during oil change intervals. Depending on the degree of contamination, it may be necessary to purge contaminated grease from seals more often (at least every 3 to 6 months). Purge grease from seals by first cleaning grease fitting and then slowly pump fresh grease, **WITH A HAND GREASE GUN**, through the seal cavity until fresh grease flows out along the shaft. Wipe off purged grease. Cooling accessories can be removed to access grease purge without removing shaft connection on motor.

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

GREASE LUBRICATED BEARINGS — Grease those bearings of specially mounted drives that require grease lubrication during oil change intervals or every 6 months or 2500 hours of operation, whichever occurs first.

WARNING: *Greases in Table 11 contain harmful substances not allowed in the food processing industry. If grease could contaminate the product, as in the food and drug industries, the grease originally supplied with gear drive must be removed and replaced with grease listed in Table 19. Simply purging grease with grease gun will not remove all grease and cross-contamination will likely occur. Refer to gear drive assembly/disassembly instructions. Grease registered as H1 by NSF, National Sanitation Foundation, is suitable for food processing applications.*

STORED & INACTIVE GEAR DRIVES

Each drive is protected with a rust preventive 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.

TABLE 11 — Conventional NLGI #2 Grade Grease ▲ for Grease Lubricated Bearings & Grease Purged Seals
-18° to +93°C (0° to 200°F)

Manufacturer	Lubricant
Chevron / Texaco / Caltex	Multifak EP 2
Citgo Petroleum Corp.	Lithoplex RT 2 Premium Lithium EP 2
ExxonMobil / Esso	Mobilux EP 2 Mobilith SHC 460 ■
Petro-Canada Lubricants	Precision General Purpose EP2
Phillips 66 / Conoco / 76 Lubricants / Kendall	Multiplex Red
Shell Oil Co.	Gadus S1 V220-2
Total Lubricants USA / Keystone Div. Penwalt Corp.	Multis 2 or Multis EP 2

▲ Not suitable for food grade applications.

■ High performance synthetic alternate.

Grease application or re-lubrication should be done at temperatures above -7°C (20°F). If grease must be applied at cooler temperatures consult lubricant supplier for recommendations.

If a gear drive is to be stored, or is inactive after installation beyond the above periods, add Nox-Rust VCI-10* vapor-phase rust inhibitor. For drives that have oil installed, add Nox-Rust VCI-10 vapor-phase rust inhibitor at the rate of 2% of sump capacity as shown in Table 12. For drives without oil, add Nox-Rust VCI-10 vapor-phase rust inhibitor at the rate of one ounce per cubic foot of internal drive space. 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. Oil troughs and pans must also be primed. Refer to Manual 128-014 for “Start-up after Storage” instructions.

* Product of the Daubert Chemical Company, Chicago, Illinois.

Periodically inspect stored or inactive gear drives and add Nox-Rust VCI-10 every six months, or more often if necessary. Indoor dry storage is recommended.

The vented dipstick should be replaced with a plug (vented dipstick should be attached to gear drive for future use) so that the protective rust inhibiting atmosphere is sealed inside the drive. Install vented dipstick when preparing drive for operation.

WARNING: The rust preventative oil from the factory and Nox-Rust VCI-10 are not H1 registered with the NSF (National Sanitation Foundation) as suitable for food processing applications. When Food Grade Lubricants are to be used, it is the end users responsibility to properly flush and prepare the drive for Food Grade service. Contact the lubricant manufacturer for specific information and flushing procedures.

TABLE 12 — Nox-Rust VCI-10

(Add to stored or Inactive Drives with conventional gear lubricants)

Unit Size	NOX-RUST VCI-10	
	2% of Sump Capacity Liters	2% of Sump Capacity Quarts
M107	0.3	0.3
M117, M127	0.6	0.6
M133, M137	0.7	0.7
M143, M145, M147	1.1	1.1
M153, M155, M157	1.2	1.3
M163, M165, M167	1.5	1.6
M173, M175, M177, M187	2.5	2.6
M193, M195, M197	3.9	4.1
M203, M207	3.6	3.8
M213, M215, M217	6.2	6.6
M223, M225, M227	5.9	6.3
M237	8.5	9.0
M243, M247	10.8	11.5
M253, M257	12.6	13.3
M263, M267	16.2	17.1
M273, M277	20.4	21.5

FOOD GRADE LUBRICANTS

Guidance for selecting petroleum-based and synthetic-based food grade lubricants are shown below in Table 13. For general lubrication guidelines, refer to the first part of the “Lubrication Recommendation” Section. Approved Food Grade lubricants meeting the specific requirements are listed in Tables 16, 17 & 18 for Petroleum-based EP, synthetic-PAO EP, and synthetic-PAG EP, respectively. Failure to use an approved lubricant voids warranty.

WARNING: SERVICE FACTOR REQUIREMENTS — Using petroleum-based or synthetic PAO food grade lubricants require a minimum service factor of 1.50 or 0.25 added to the recommended catalog service factor, whichever is greater.

FOOD GRADE LUBRICANT SELECTION PROCESS

1. Refer to Table 14 or 15 for proper lubricant viscosity grade based on ambient temperature range.
2. Refer to Table 13 for summary of food grade lubricant type.
3. Using proper food grade lubricant table and viscosity grade, select desired lubricant manufacturer name.
4. Refer to drive nameplate for approximate oil capacity to purchase.

TABLE 13 — Summary of Food Grade Lubricants and Greases

Petroleum-Based ♦
Extreme Pressure (EP) See Table 16
Synthetic Lubricant, Polyalphaolefin Type (PAO) ♦
Extreme Pressure (EP) See Table 17
Synthetic Lubricant, Polyalkylene Glycol Type (PAG)
Extreme Pressure (EP) See Table 18
Food Grade Grease
See Table 19

♦ These lubricants require a minimum service factor of 1.50 or 0.25 added to the recommended catalog service factor, whichever is greater.

TABLE 14 — Viscosity Grade Recommendations For Food Grade Petroleum-Based Extreme Pressure (EP) Lubricants

Ambient Temperature ▲ Range	-9° to +16°C (+15° to +60°F)	+10° to +52°C (+50° to +125°F)
ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5	6

▲ See section on oil pumps

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump (including DuraPlate), cold temperature oil viscosity is very important. Lubricant viscosity at start-up generally should not exceed 3250 cSt (15,000 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.

TABLE 15 — Viscosity Grade Recommendations for Food Grade Synthetic Extreme Pressure (EP) Lubricants

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

▲ See section on oil pumps

FOOD GRADE LUBRICANTS (TABLES 16, 17, 18 & 19) — Food grade lubricants are a class of lubricants registered as H1 by NSF, National Sanitation Foundation. They contain base stock and additives which comply with Food and Drug Administration Title 21 CFR 178.3570 regulations for lubricants with incidental food contact. Base stock can be petroleum oil or different types of synthetic lubricant. Food grade lubricants are not same as biodegradable or environmentally friendly lubricants.

Rust and corrosion inhibitors used to protect gear drive during shipment are not qualified as food grade fluids. Flush out inhibitor oil before filling with food grade lubricant.

Tables 16, 17, 18 & 19 list food grade lubricants that have performance properties meeting Rexnord/Falk specifications. They are not exclusive recommendations but serve as a guide for making proper lubricant selections.

CLIMATE CONDITIONS — Ambient temperature in immediate vicinity of gear drive is very important for determining viscosity grade. Table 14 provides viscosity grade selections for petroleum-based lubricants. See Table 15 for synthetic lubricants.

Polyalkylene glycols (PAG) are another class of synthetic lubricants. They have similar performance properties as PAO synthetics - low pour point, stable at elevated temperatures, and high viscosity index. PAG's have exceptional tolerance to water contamination.

WARNING: Polyalkylene glycols (PAG's) are not compatible with petroleum mineral oil or PAO synthetic lubricants and must not be topped off with either lubricant. In addition, petroleum mineral oils or PAO synthetic lubricants must not be used to top off systems containing PAG's. Do not use PAG's in gear drives with painted interior housing walls unless paint compatibility is checked. Compatibility with oil seals and gasket materials must be checked prior to use. PAG lubricants are not compatible with polycarbonate sight glass. Use glass sight glass.

TABLE 16 — Food Grade Petroleum-Based EP (Extreme Pressure) Lubricants — NSF (National Sanitation Foundation) H1 Registered
 Maximum operating temperature of lubricants 93° (200°F)

ISO Viscosity Grade	220	320
AGMA Viscosity Grade	5	6
Viscosity cSt @ 40°C ■	198-242	288-352
Viscosity SSU @ 100°F	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name
Petro-Canada	Purity FG EP 220	Purity FG EP 320
Total Lubricants USA, Inc.	Nevastane EP 220	Nevastane EP 320

■ Kinematic viscosity in units of mm²/S is equivalent to cSt (centistokes)

TABLE 17 — Food Grade Synthetic PAO (Polyalphaolefin) EP (Extreme Pressure) Lubricants♦ — NSF (National Sanitation Foundation) H1 Registered
 Maximum operating temperature of lubricants 93° (200°F)

ISO Viscosity Grade	150	220	320
AGMA Viscosity Grade	4	5	6
Viscosity cSt @ 40°C ■	135-165	198-242	288-352
Viscosity SSU @ 100°F	626-765	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name	Lubricant Name
ExxonMobil	Mobil SHC Cibus 150	Mobil SHC Cibus 220	Mobil SHC Cibus 320
Kluber Lubrication	Kluberoil 4 UH1 N 150	Kluberoil 4 UH1 N 220	Kluberoil 4 UH1 N 320
Lubriplate Lubricants Co.	Lubriplate SFGO Ultra 150	Lubriplate SFGO Ultra 220	Lubriplate SFGO Ultra 320
Petro-Canada	---	Purity FG Synthetic EP 220	---
Total Lubricants USA, Inc.	Nevastane SL 150	Nevastane SL 220	Nevastane SL 320

■ Kinematic viscosity in units of mm²/S is equivalent to cSt (centistokes)

♦ Lubricants in this table may not technically be classified as extreme pressure lubricants; however they have been approved for use in V-Class gear drives based on laboratory bench tests or factory testing.

TABLE 18 — Food Grade Synthetic PAG (Polyalkylene Glycol) EP (Extreme Pressure) Lubricants♦ — NSF (National Sanitation Foundation) H1 Registered
 Maximum operating temperature of lubricants 93° (200°F)
 See Warning Note below.

ISO Viscosity Grade	150	220	320
AGMA Viscosity Grade	4	5	6
Viscosity cSt @ 40°C ■	135-165	198-242	288-352
Viscosity SSU @ 100° F	626-765	918-1122	1335-1632
Manufacturer	Lubricant Name	Lubricant Name	Lubricant Name
Exxon Mobil	Glygoyle 150	Glygoyle 220	Glygoyle 320
Kluber Lubrication	Klubersynth UH1 6-150	Klubersynth UH1 6-220	Klubersynth UH1 6-320
Lubriplate Lubricants Co.	PGO-FGL Synthetic Gear Oil 150	PGO-FGL Synthetic Gear Oil 220	PGO-FGL Synthetic Gear Oil 320

WARNING: Polyalkylene glycol (PAG) lubricants are not compatible with petroleum mineral oils or PAO synthetic lubricants. PAG's must not be mixed or used to top off either petroleum mineral oils or PAO synthetic lubricants.

■ Kinematic viscosity in units of mm²/s is equivalent to cSt (centistokes)

♦ Lubricants in this table may not technically be classified as extreme pressure lubricants; however they have been approved for use in V-Class gear drives based on laboratory bench tests or factory testing.

PREVENTIVE MAINTENANCE

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Tighten all external bolts and plugs where necessary. See Table 5 for fastener and wrench sizes. 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. CAUTION: Oil may be hot. Clean up any spilled oil per applicable environmental standards.
2. Immediately flush drive (including troughs and pans) 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 25 - 50% 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 food grade 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 food grade 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 ANALYSIS AND CHANGES

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

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%.
7. Solid particle contamination code exceeds 25/22/18 for particle sizes $\geq 4/\geq 6/\geq 14$ microns, respectively per ISO 4406.

Guidelines for when to change food grade polyalkylene glycol type lubricant are:

1. Water content is greater than 3%.
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. Viscosity changes more than ±15%.
6. Solid particle contamination code 25/22/18 per ISO 4406.

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

PETROLEUM LUBRICANTS (FOOD GRADE) — In the absence of oil analysis, change gear oils 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, lubricants should be changed every 3 to 4 months or 1500 to 2000 hours. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature, refer to Table 14. Lubricant suppliers can test oil from the drive periodically and recommend economical change schedules.

SYNTHETIC LUBRICANTS (FOOD GRADE) — In the absence of oil analysis, synthetic lube change intervals can be extended to 8000 hours depending upon operating temperatures. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Table 15.

GREASE LUBRICATED SEALS AND BEARINGS

All drives and some backstops have grease lubricated seals. Some specially mounted drives have grease lubricated bearings. Drives are shipped with NLGI #2 grade grease in the seal housing cavities and in those bearings requiring grease lubrication unless otherwise specified.

GREASE LUBRICATED SEALS — Falk V-Class gear drives are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts into the drive.

Grease seals during oil change intervals with one of the food grade greases listed in Table 19. Depending on the degree of contamination, it may be necessary to purge contaminated grease from seals more often (at least every 3 to 6 months). Purge grease from seals by first cleaning grease fitting and then slowly pump fresh grease, **WITH A HAND GREASE GUN**, through the seal cavity until fresh grease flows out along the shaft. Wipe off purged grease. Cooling accessories can be removed to access grease purge without removing shaft connection on motor.

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

GREASE LUBRICATED BEARINGS — Grease those bearings of specially mounted drives that require grease lubrication during oil change intervals or every 6 months or 2500 hours of operation, whichever occurs first, with one of the food grade greases listed in Table 19.

If grease could contaminate the product, as in the food and drug industries, the grease originally supplied with gear drive must be removed and replaced with grease listed in Table 19. Simply purging grease with grease gun will not remove all grease and cross-contamination will likely occur. Refer to gear drive assembly/disassembly instructions. Grease registered as H1 by NSF, National Sanitation Foundation, is suitable for food processing applications.

TABLE 19 — Food Grade Grease▲ for Grease Lubricated Bearings & Grease Purged Seals, NLGI #2 Grade
-18° to +93°C (0° to 200°F)

Manufacturer	Lubricant
Bel-Ray Company, Inc.	No-Tox HD Grease 2
Chevron USA, Inc. (Texaco/Caltex)	Chevron FM ALC EP 2
Exxon Mobil	Mobil SHC Polyrex 462
Kluber Lubrication	Klubersynth UH1 14-222
Lubriplate	Lubriplate FGL-2
Total Lubricants USA, Inc.	Nevastane HT/AW 2
Petro-Canada	Purity FG
Phillips 66 / Conoco / 76 Lubricants / Kendall	Food Machinery Grease 2

▲ NSF (National Sanitation Foundation) H1 Registered.

Grease application or re-lubrication should be done at temperatures above -7°C (20°F). If grease must be applied at cooler temperatures consult lubricant supplier for recommendations.

STORED & INACTIVE GEAR DRIVES

Prior to shipment from the factory, all Rexnord enclosed gear drives are protected internally against corrosion with a rust preventative oil. A vapor phase rust inhibitor may also be added.

WARNING: *These corrosion inhibitors are not H1 registered with the NSF (National Sanitation Foundation) as suitable for food processing applications. When Food Grade Lubricants are to be used, it is the end users responsibility to properly flush and prepare the drive for Food Grade service. Contact the lubricant manufacturer for specific information and flushing procedures.*

Rod End Adjustable Torque Arm Installation

INTRODUCTION

The Falk V-Class rod end type adjustable torque arm is available for all shaft-mounted Falk V-Class sizes, both parallel shaft Type VP and right angle Type VR. It is used to support the drive when mounted in a standard horizontal position; other positions may be available (consult the Factory). The torque arm accessory is suitable for use on swing bases, bedplates, or mounted directly to the drive. Three styles of rod end torque arms are available:

- (1) Standard style for swing base or bedplate mounting;
- (2) Clevis style for mounting directly to the drive foot;
- (3) Turnbuckle style for greater length and adjustment.

The torque arm requires mounting holes in the driven equipment support structure to provide for attachment. The customer is responsible for determining the structural integrity of their support member.

MOUNTING

It is natural for the drive system to move during operation. This movement is due to runout from the driven equipment shaft, gear drive low-speed shaft and the connection of the two. Plain spherical bearing rod ends form a link to provide a resilient mounting support that accommodates the motion of the drive. To allow for maximum movement, the torque arm must be perpendicular to the supports and rod ends centered in the mounting anchor bracket. Restricting the drive's motion in any way may result in premature failure of the drive or driven equipment.

INSTALLATION

1. Position the drive on the driven equipment shaft such that the torque arm link is centered in the anchor bracket. Ideally, the anchor bracket mounting holes should be added to the structure after the drive has been secured to the driven equipment.

NOTE: Do not fasten the torque arm to the support structure at this time.

2. Secure the drive to the driven equipment via the TA Bushing, shrink disc or rigid coupling connection.

3. Mount the anchor bracket or clevis to the drive or drive system if not already done. Locate the position of the anchor bracket to be mounted to the support structure. Match drill the mounting holes for the fastener size listed in Table 20; class 8.8 or grade 5 minimum. Lock washers and flat washers are also required.

NOTE: Torque arm must be vertical ($\pm 1^\circ$) in both directions after installation.

4. (IF REQUIRED) Assemble rod end components to create a link. A combination of male/female rod ends, clevis/male rod end or turnbuckle/male rod ends are required dependent on torque arm style. All styles require jam nuts to lock linkage. Refer to Figures 2 through 4.

NOTE: Rod ends must be assembled such that the relative position of one rod end head to the other is parallel. Loosen locknut and adjust if necessary. See Figure 5.

5. For Standard and Turnbuckle style torque arm, install pin through one lug of anchor bracket mounted to drive. Position spacer, then rod end and finally second spacer on pin. Finish positioning pin within anchor bracket. Install retaining ring to secure the pin. See Figures 2 through 4.
6. Install pin in anchor bracket mounted to supporting structure with spacers in a similar manner. The drive may need to be rotated about the low-speed shaft to install second pin. If the drive has a backstop, it may be necessary to disconnect the backstop to rotate the drive. Refer to the backstop instructions for removal.
7. If the drive system is not horizontal, the rod end linkage can be adjusted (within the limits indicated in the catalog or certified print) to level the drive.
8. Verify the torque arm link is centered in the anchor bracket and is not restricting motion of the drive.
9. Some rod ends may be provided with grease fittings for lubricating. Grease rod end at every scheduled maintenance or at least every six months. See Table 11 for approved greases.

TABLE 20

Drive Size	Bolt Size	
	mm	inch
M107	M12 x 1.75	0.500 - 13 UNC
M117	M16 x 2.0	0.625 - 11 UNC
M127-157	M24 x 3.0	1.00 - 8 UNC

FIGURE 2

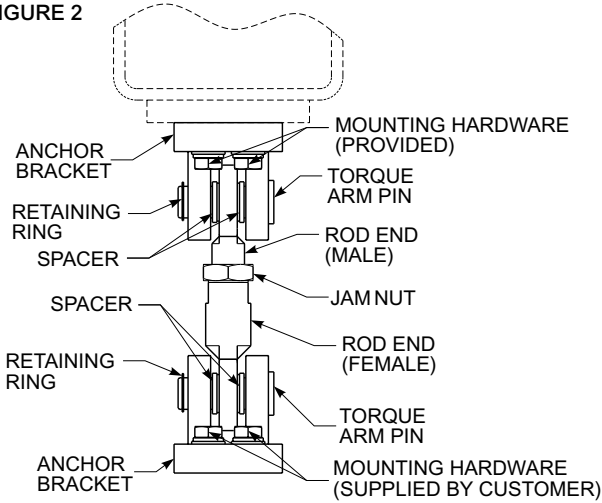


FIGURE 3

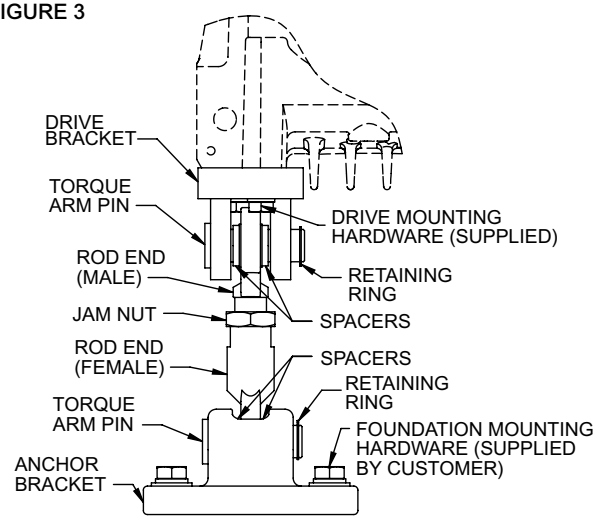


FIGURE 4

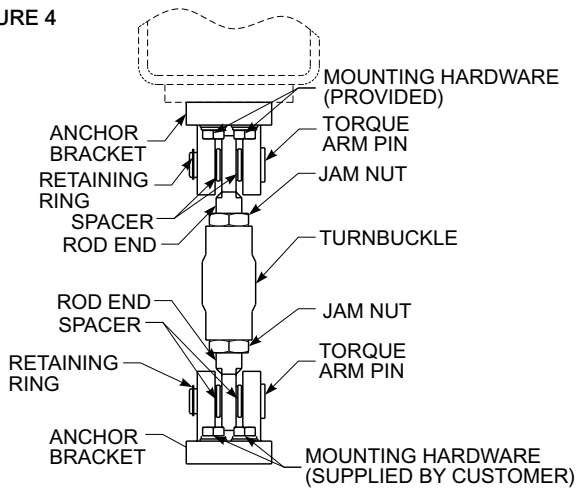
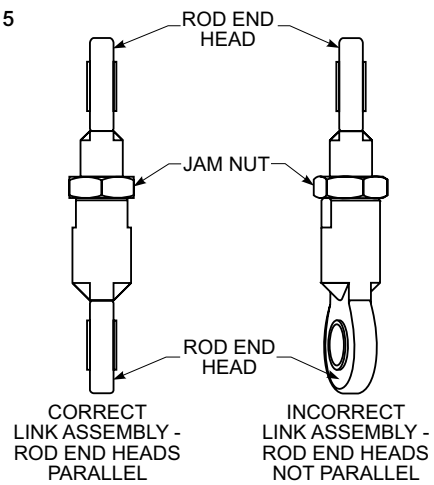


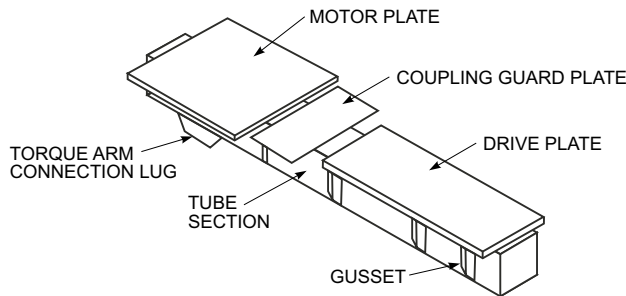
FIGURE 5



Swing Base Installation

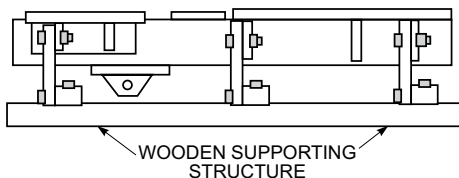
INTRODUCTION

The Falk V-Class swing base is a welded steel structure designed to support a motor and a right angle Type VR, shaft-mounted drive. The swing base itself is a length of square cross-sectional tubing with plates welded to it for the motor and drive. The motor and drive plates are not machined, and are supported by gussets for additional strength. A torque arm attaches to the tube section near the motor end of the swing base.



SUPPORTING THE SWING BASE

The torque arm connection lug prevents the swing base from lying flat on the ground; therefore, a supporting structure is required for mounting the gear drive and motor to the swing base. This structure is typically built from wood and is unique to each swing base. All gussets have a 19 mm (0.75 inch) diameter hole for securing the swing base to the supporting structure.



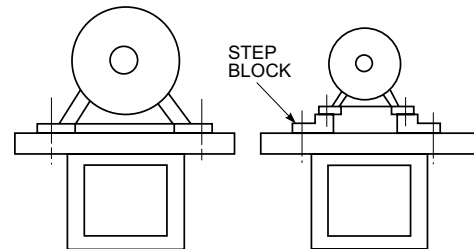
MOUNTING GEAR DRIVE TO SWING BASE

It is Rexnord's standard procedure to mount the drive to the swing base at the Factory. These instructions are to be followed when field mounting of the drive to the swing base is required. Use of broad, flat shims between the gear drive and mounting plate are recommended to prevent distortion of the housing when the drive is bolted down. Jacking screw holes are provided in gear drive housing to aid in fixing the shims. Begin at the low-speed shaft end and level across the length and then the width of the gear drive. Use a feeler gauge to ensure that all pads are supported. Bolt down the drive to the torque specified in Table 4, page 6.

MOUNTING MOTOR AND COUPLING ALIGNMENT

Shims are provided for motor mounting. Holes must be drilled into the swing base motor plate for mounting of the motor. Step blocks are also provided for some small frame motors. Use a feeler gauge to ensure that all motor pads

are firmly seated. Motor mounting needs to be done in conjunction with coupling alignment to control angular and offset misalignment. Refer to the coupling manufacturer's manual for specific instructions. Bolt down the motor to the torque specified in Table 4, page 6.

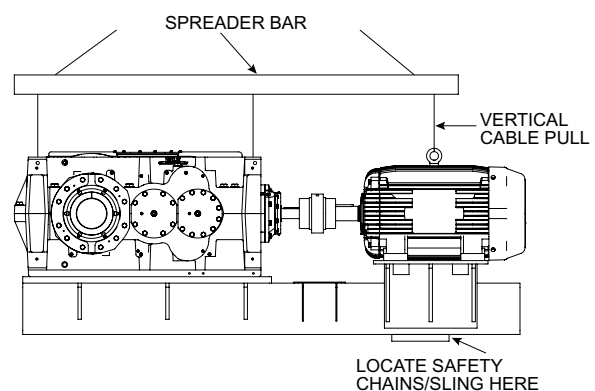


COUPLING GUARD

The coupling guard may be trimmed in order to fit the height and shaft extension requirements. Refer to the coupling guard installation manual for instructions on trimming the guard. After the guard has been trimmed, holes can be drilled in the coupling guard plate on the swing base. The guard can then be bolted down to the plate.

LIFTING THE SWING BASE ASSEMBLY

After the drive, motor, and coupling have been mounted to the swing base, the completed assembly can be lifted into position for installation on the driven shaft. The motor eyebolt and the lifting holes on the drive housing can be used as cable attachment points. The motor eyebolt is strongest when the cable pull is vertical. To ensure that cable pull on the motor eyebolt is vertical, use of a spreader bar is recommended. See the sketch below. To ensure safety, chains or a sling should be placed behind the torque arm connection.



MOUNTING SWING BASE ASSEMBLY TO DRIVEN EQUIPMENT

Mount the gear drive to the driven shaft (see page 3). Secure the torque arm to the foundation per the instructions in Appendix A.

Alignment-Free Assembly and Installation

INTRODUCTION

The Alignment-Free Drive design consists of a shaft-mounted gear drive, bell housing, torque arm, 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 21 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 21 — Tightening Torques

Drive Size	Bolt Size	Tightening Torque	
		Nm	lb-ft
M117	M24	780	570
M127	M24	780	570
M133, M137	M24	780	570
M143, M145, M147	M30	1540	1140
M153, M155, M157	M30	1540	1140
M163, M165, M167	M36	2720	2000
M173, M175, M177	M36	2720	2000
M187	M36	2720	2000
M193, M195, M197	M24	780	570
M203, M207	M24	780	570

HIGH-SPEED SHAFT FAN

High-speed shaft fans are available for all Falk V-Class Alignment-Free Drives. Fan size and position is dependent on bell housing casting and high-speed coupling, for sizes M117 thru M187, and by drive size for M193 thru M207.

Mount the fan hub on the gear drive high-speed shaft such that the flange of the hub is toward the gear drive. Locate the hub axially on the shaft at the values listed in Table 22 or Table 22A. Dimensions listed are from the inside face of the bell housing to the far side of the hub. See Figure 6. 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.

TABLE 22 — Fan Hub Location

Coupling Size	Bell Housing Casting Number ♦	Fan Hub Location	
		mm	inch
1420HFDD	D011723	108	4.25
1480HFDD	D011724	106	4.17
1584HFDD	D011725	87	3.43
1660HFDD	D011726	108	4.25
Spacer Coupling	D011723	108	4.25
Spacer Coupling	D011725	87	3.43

♦ Casting number located on inside sidewall of bell housing.

TABLE 22A — Fan Hub Location

Drive Size	Fan Hub Location	
	mm	Inch
M193, M195, M197	468	18.23
M203, M207	468	18.23

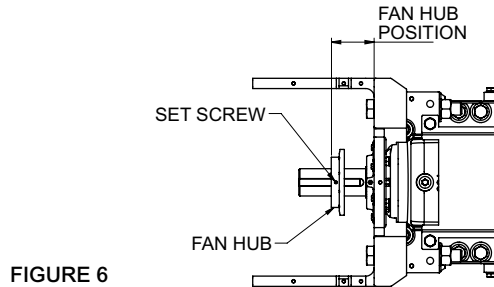


FIGURE 6

Assemble split fan to fan hub with fan support ring on the opposite side of the fan as the hub flange. Apply Loctite #242 or equivalent to fastener threads and tighten.

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

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 7.

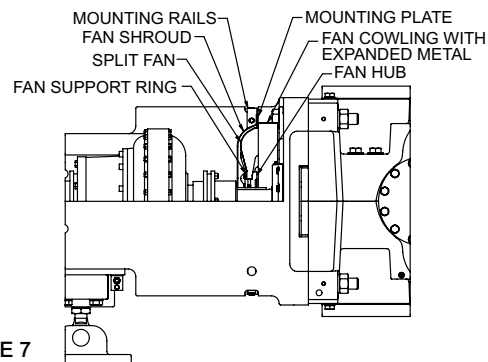


FIGURE 7

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 to 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 25 mm (1 inch) from the nearest housing surface by bending deflector toward or away from the drive.

TORQUE ARM

The carriage, adjusting rod, brackets and support bar are furnished pre-assembled from the Factory. Assemble the

rod ends with heads perpendicular to each other (90°) as shown in Figure 8. Rod end threads must be engaged a minimum of one times the thread diameter. Attach female rod end to carriage with pin. Place a spacer on each side of the rod end. Secure pin with locking plate. Carriage may be adjusted from center to either far end of the housing to facilitate installation of pin.

Ensure that adjusting rod locking plate is NOT installed at this time, as it will prevent adjustment of the torque arm assembly. Assemble anchor bracket to male rod end with a spacer on each side and secure with pin and retaining ring.

LIFTING THE ALIGNMENT-FREE DRIVE

Lifting points are provided on the corners of the motor end of the bell housing. See Figure 9. Lift by these and the provisions provided on the drive housing itself to maneuver the drive. DO NOT lift by the motor lifting eye.

MOUNTING THE DRIVE

Mount the Alignment-Free Drive to the driven equipment, per pages 2 and 3 of this manual. With Alignment-Free Drive assembly supported, rotate adjusting screw to move torque arm to desired position and to line up with foundation. Torque arm must be perpendicular in both directions ($\pm 1^\circ$). Adjust screw if not. Install locking plate to lock the adjusting screw (plate can be installed on either side). Remove support from drive and secure anchor bracket to foundation. Use M24 Class 8.8 (1 inch Grade 5) or better fasteners with lock and flat washers to mount anchor bracket. Slots are provided such that torque arm can be mounted perpendicular.

CAUTION: Do NOT adjust torque arm screw after support is removed and torque arm is under any load.

FIGURE 8

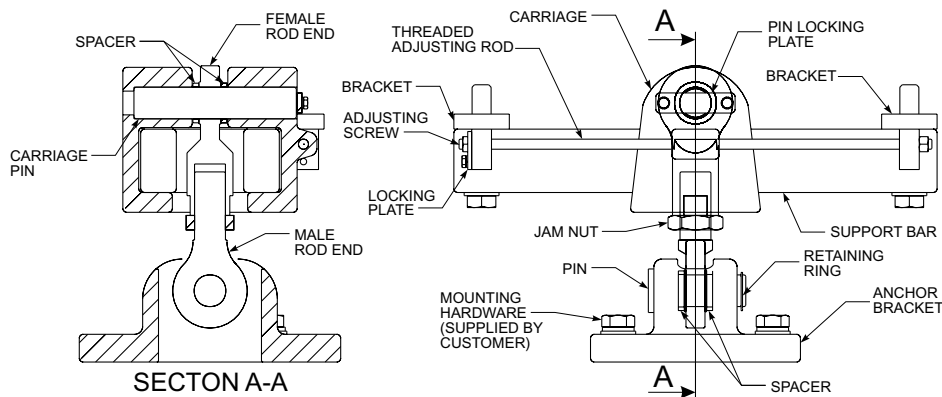
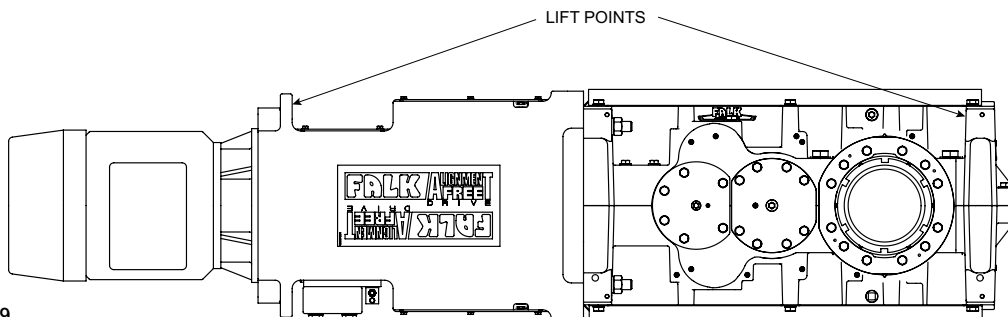


FIGURE 9



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. Note: Electric fans require unimpeded airflow to operate. Maintain a minimum of 25 mm (1.0") clearance between fan shroud and the closest obstruction (coupling guard, etc.) for optimal performance. 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 branded as Multifan. (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 manufacturer. If you have any questions, contact the 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, 24.
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:

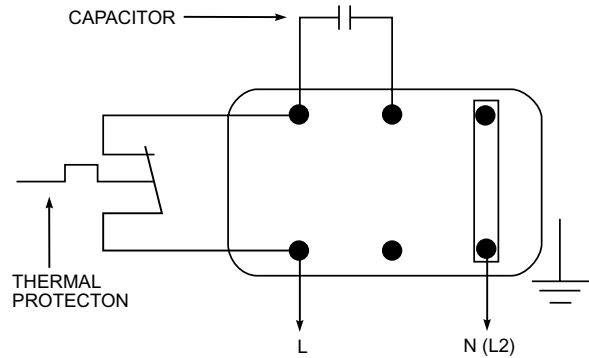
1. Switch off the main power supply and lock out before installing, servicing or making connections to the fan.
2. Installation work and electrical wiring must be done by a qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
3. The fan should 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 10 for wiring diagrams.

FIGURE 10

SINGLE PHASE TYPE - E

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

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

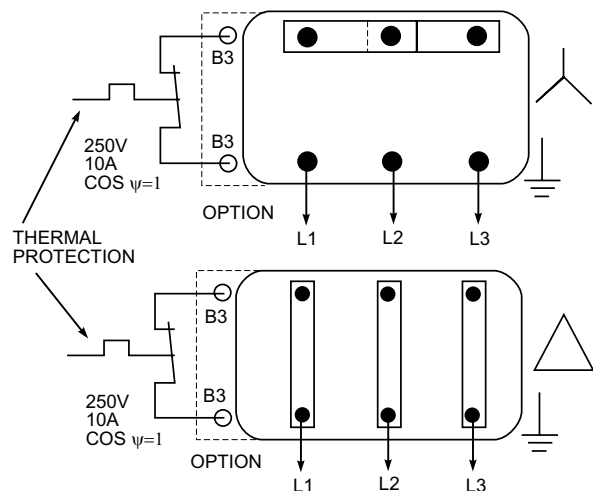


SINGLE PHASE TYPE - D

3 PHASE

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

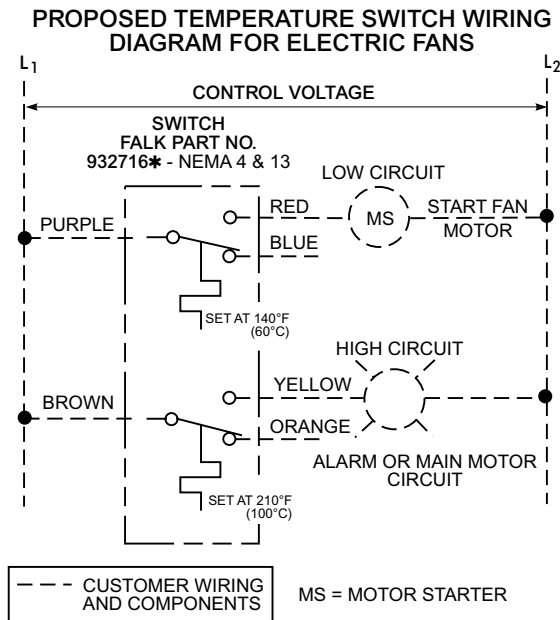
3 PHASE 220/380V - 60Hz
3 PHASE 208/360V - 60Hz
3 PHASE 265/460V - 60Hz



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.
7. A temperature switch is provided to control oil sump temperature. See Figure 11 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.

10. Remove proper condensation plug. See Figure 12 below. Do not discard. Plug is to be used during cleaning.

FIGURE 11



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

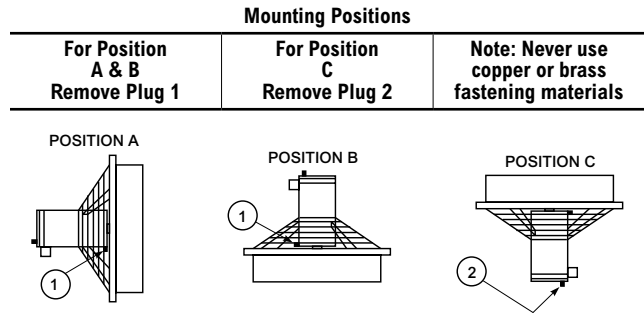
AC VOLTS	AMP	DC VOLTS	AMP
125	15	6-12 **	15
250	15	24 **	5
480	15	125	0.05
		250	0.03

* MAXIMUM CONTINUOUS CURRENT

** Reference only.

8. Connect power to the motor using an approved wiring method. See Figure 10 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.

FIGURE 12



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 HNO ₃ -HCL	Esters	1:2 Trichloroethylene
Mixture of HNO ₃ -H ₂ SO ₄	Benzene	Trichloroethylene
Sulfuric Acid, fuming	Gasoline	Diethyl Ether
Carbon Tetrachloride	Toluene	Chlorine, Liquid
Chlorobenzene	Xylene	

CLEANING — When cleaning fan, both condensation holes (Figure 12, 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.

Thrust Plate & Fastener Usage

Thrust plate usage is required for taper bushing shaft-mounted drives. For additional information and assembly/removal instruction refer to pages 3 through 5.

TABLE 23 — Metric & Inch Bore Bushings

Drive Size	Retention Fasteners ♦		Backing Bolt †		Removal Bolt †
	mm	Inch	mm	Inch	mm
M107	M20 x 2.5 x 75	0.750-10UNC x 3.00	M20 x 2.5 x 30	0.750-10UNC x 1.25	M24 x 3 x 80
M117	M24 x 3 x 90	1.000-8UNC x 3.50	M24 x 3 x 40	1.000-8UNC x 1.50	M30 x 3.5 x 80
M127	M24 x 3 x 90	1.000-8UNC x 3.50	M24 x 3 x 40	1.000-8UNC x 1.50	M30 x 3.5 x 80
M133 M137	M24 x 3 x 90	1.000-8UNC x 3.50	M24 x 3 x 40	1.000-8UNC x 1.50	M30 x 3.5 x 80
M143 M145 M147	M30 x 3.5 x 100	1.125-7UNC x 3.75	M30 x 3.5 x 50	1.125-7UNC x 1.75	M36 x 4 x 90
M153 M155 M157	M30 x 3.5 x 100	1.125-7UNC x 3.75	M30 x 3.5 x 50	1.125-7UNC x 1.75	M36 x 4 x 90
M163 M165 M167	M30 x 3.5 x 100	1.125 x 7UNC x 3.75	M30 x 3.5 x 50	1.125 x 7UNC x 1.75	M36 x 4 x 90

♦ Retention fastener is factory-supplied (Class 8.8 metric & Grade 5 inch).

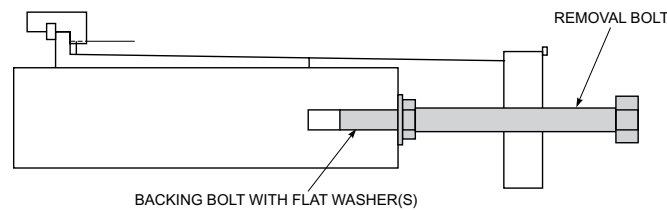
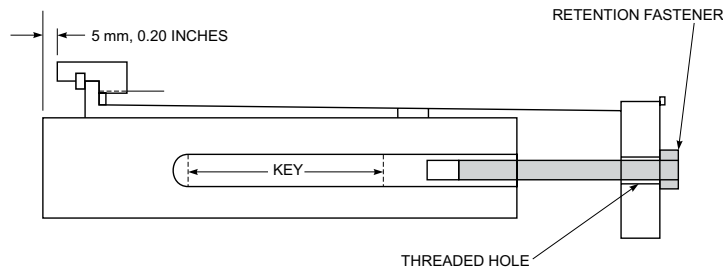
† Backing and removal bolts are user-supplied (removal bolt Class 8.8 minimum).

TABLE 24 — Metric & Inch Bore Bushings

Drive Size	Bushing Size	Retention Fasteners♦	Tightening Torque		Removal Bolt Size & Minimum Length †	Max Tightening Torque		Backing Bolt Size & Minimum Length †
			Nm	lb-ft		Nm	lb-ft	
M173 M175 M177 M187	190-200 mm	M24 x 3 x 220 mm	640	470	M30 x 3.5 x 200 mm	1355	1000	M24 x 3 x 45 mm
	7.50-8.00 inch	1.250-7UNC x 9 inch	1400	1060	1.500-6UNC x 7.50 inch	1125	830	1.250-7UNC x 3.00 inch

♦ Retention fastener is factory-supplied (Class 8.8 metric & Grade 5 inch).

† Backing and removal bolts are user-supplied (removal bolt Class 8.8 metric & Grade 5 inch minimum).



AUXILIARY RELEASE SYSTEM - USER PROVIDED WHEN REQUIRED
LOOSEN BUSHING NUT AND REMOVE NUT RETAINING RING BEFORE USING
ADD FLAT WASHERS AT BACKING BOLT IF NEEDED

AirMax Plus Breather Installation and Maintenance

INTRODUCTION

Breathers are required on enclosed equipment to equalize the internal housing pressure as the drive or equipment temperature changes during operation and idle time in relation to the ambient temperature. As air is transferred in and out to equalize pressure, the AirMax® Plus™ breather provides contamination and moisture control preventing contamination of the gear drive.

INSTALLATION INSTRUCTIONS

Breathers are shipped loose and must be installed prior to drive or equipment operation. The following instructions are for Falk AirMax Plus AM-HG-8 installation. See Figure 13 for reference.

1. Remove airtight cap from bottom of breather standpipe.
2. Red air vent plugs must be removed prior to operation based on air flow requirements. Open air vents should be 180° from each other. For ALL Falk/Rexnord gear drives, remove two (2) plugs from the bottom air vents.
3. Install breather on gear drive. The breather threads directly into a pipe tap hole or fitting. Hand-tighten only to seal o-ring against pipe fitting.

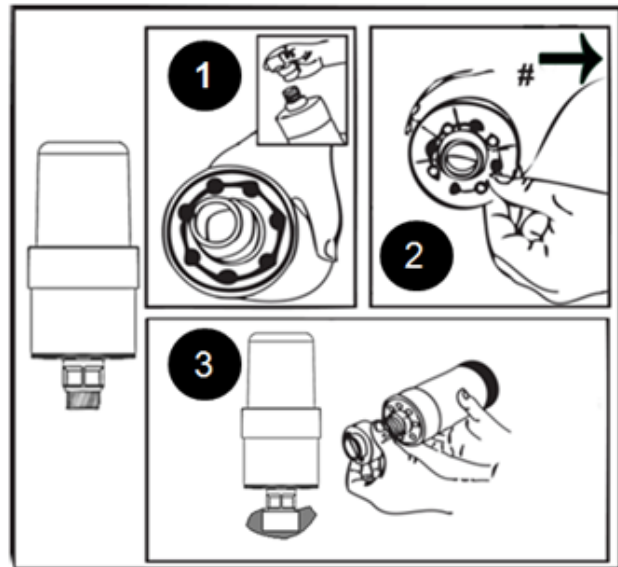


FIGURE 13

SPECIFICATIONS

See Table 25 for breather specifications.

TABLE 25 – Falk AirMax Plus Specifications

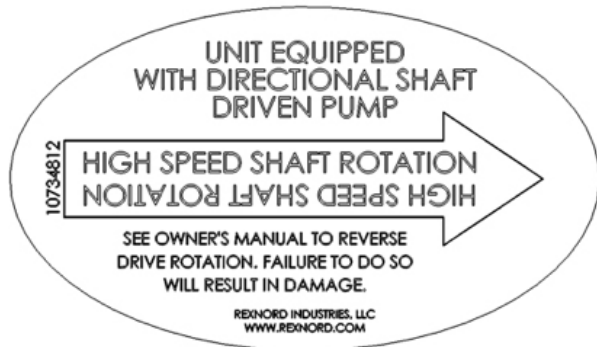
Product Specification	Model
Max. Flow Rate @ 1 psid	2.50 cfm 70.5 lpm
Filtration	3μ absolute (β ₃ > 200)
Connection	1" NPT
Falk P/N	2930751

MAINTENANCE

Falk AirMax Plus breathers have visual indication when they need to be changed. As the breather functions, the silica gel material changes color from blue to pink as it absorbs moisture. When all the material has turned pink in color, it is time to replace the breather. Life of breather is dependent on operating conditions and ambient conditions (humidity). Breather should be changed every twelve (12) months regardless of color.

Changing Rotation Direction with DuraPlate Cooler

If the gearbox is equipped with a directional shaft driven pump, the following sticker will be present near the input shaft of the gearbox, on a fan shroud component. Below are the directions for re-orienting the pump to accommodate a reversed drive rotation direction.



1. Disconnect the suction and discharge hoses from the pump.
NOTE: On some units, the thermal and pressure bypass is directly connected to the discharge side of the pump. Additional disassembly may be needed in these cases. If hoses are disconnected from the bypass, note which ports the hoses were connected to so they are re-connected properly after re-assembly.
2. Remove the fasteners holding the pump to the gearbox. See below for examples of the different pump styles and which fasteners are to be removed. Note that fasteners were installed from the factory with Loctite 242 thread locker applied.

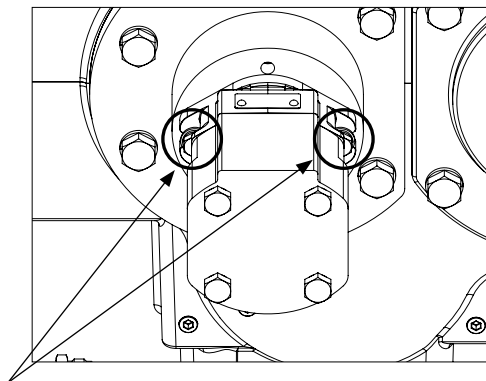


FIGURE 14 — 2-fastener flange mounted pump. Note hoses and fittings not shown for clarity.

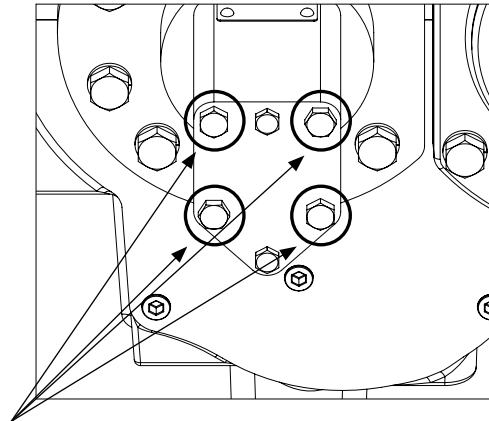


FIGURE 15 — 4-fastener through body style pump. Note hoses and fittings not shown for clarity.

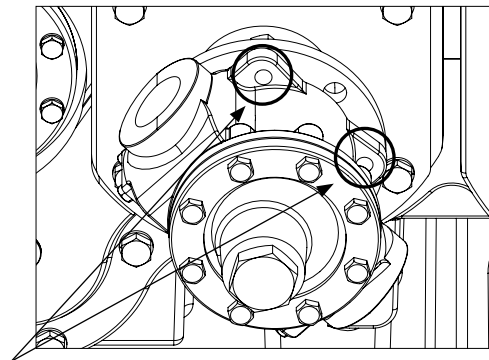


FIGURE 16 — 4-fastener flange mount style (fasteners threaded into pump). Note hoses and fittings not shown for clarity.

3. Remove the pump from the gearbox. Note that the pump was sealed to the gearbox using Loctite 515 gasket eliminator (or equivalent). Clean all traces of the gasket eliminator from both surfaces. Note that the bronze center disc element from the pump coupling assembly may fall out of the gearbox during this step. Take care to make sure it is not lost.
4. Check that the coupling hub attached to the pump shaft is still securely attached to the shaft via the setscrews. **If the hub is secure and does not move on the shaft, proceed to step 5.** If it is not secure and moves on the shaft, it must be repositioned and secured. The steps to do so are as follows:
 - a. To determine the proper position of the hub on the shaft, first make sure the bronze coupling center disc element is secure against the gearbox pinion end. See Figure 17.
 - b. Remove the set screws from the pump coupling hub and set them aside.
 - c. Using a depth micrometer or similar instrument, measure the distance from the pump mounting surface to the deepest point on the coupling center disc (the depressed, center slot). See Figure 18.
 - d. Subtract 1mm [0.040"] from the measurement

obtained in step b. This is the desired distance on the pump between the mounting surface and the coupling hub. See Figure 19. Position the pump coupling hub at that distance on the pump shaft.

- e. Apply Loctite 242 threadlocker or equivalent to the set screw threads and re-insert them into the hub. Torque to approximately 10 Ft-lbs [13.6 N-m] of torque for pump styles shown in Figure 14 and Figure 15, and approximately 23 Ft-lbs [31.2 Nm] for pump style shown in Figure 16.

CAUTION: Coupling hub material is aluminum. Excessive torque could result in stripped threads in the hub.

5. Rotate the pump 180 degrees such that the inlet and outlet ports are switched when compared to the originally installed orientation. To verify that the pump is properly oriented, compare the desired rotation direction of the pump shaft with the pump nameplate. The pump nameplate indicates which rotation direction corresponds to which flow direction.
6. Apply a bead of Loctite 515 gasket eliminator or equivalent to the pump mating surface.
7. Insert the pump back into the gearbox. Take care to align the protrusion of the pump coupling hub (attached to the pump shaft) with the slot in the pump coupling center element. If necessary, rotate pump during installation until coupling is seated.
8. Apply Loctite 242 threadlocker to the pump fasteners and reinstall. Torque to 32-39 Ft-lbs for pump styles shown in Figure 14. Torque to 16-20 Ft-lbs for pump styles shown in Figure 15. Torque to 61-74 Ft-lbs for pump style shown in Figure 16.
9. Re-attach all plumbing that was previously disconnected. Use a pipe joint sealant on any tapered threaded connections.
10. Make a note on or near the direction of rotation sticker that the shaft driven pump has been reconfigured for the opposite hand rotation as was provided from the factory for future reference.

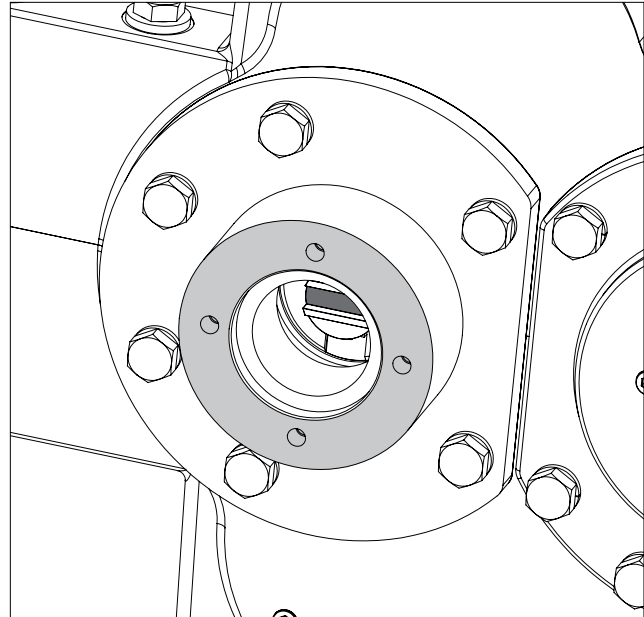


FIGURE 18 — Surfaces to measure the distance between for re-setting proper copuling hub position on pump shaft. Surfaces are indicated in gray.

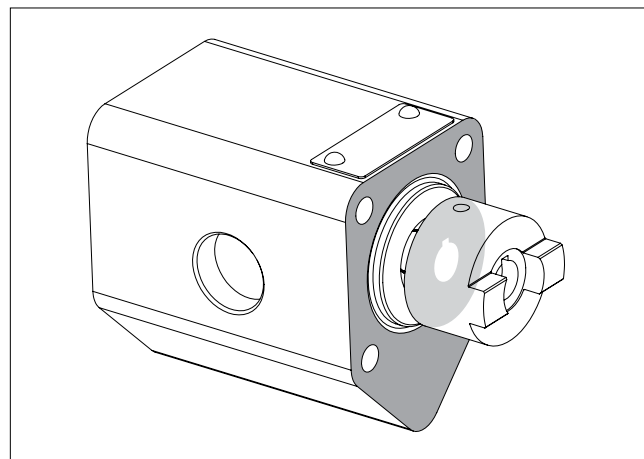


FIGURE 19 — Surfaces to set distance between on pump coupling hub assembly indicated in gray.

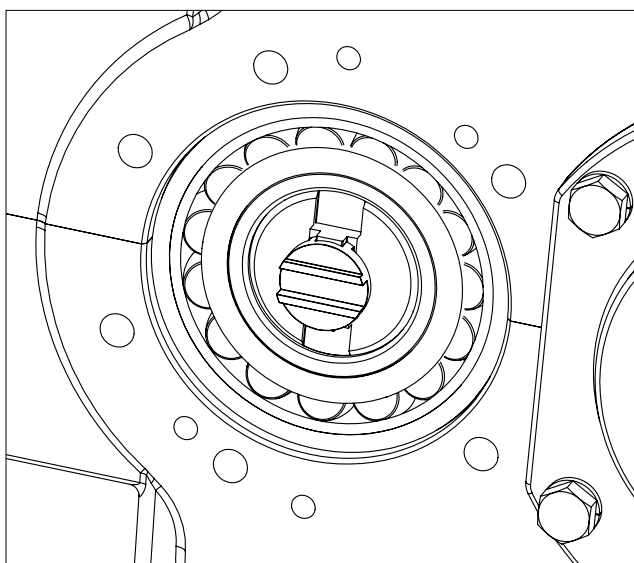


FIGURE 17 — coupling center disc element properly located against end of gearbox pinion. Pump adapter component hidden for clarity.