HOW TO USE THIS MANUAL

This manual provides detailed instructions on installation and maintenance of parallel shaft Types A, AR, AXV and right angle Types AB, ABR, ABX, and ABRC 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.

TABLE OF CONTENTS

INTRODUCTION

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

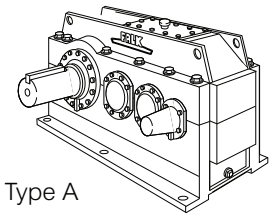
NAMEPLATE — Operate Falk gear drives only at power, speed and ratio shown on the nameplate. Before changing any one of these, submit complete nameplate data and new application conditions to the Factory for correct oil level, parts, and application approval.

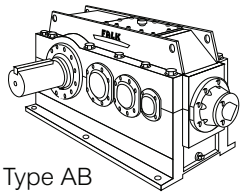
DISASSEMBLY AND ASSEMBLY — Disassembly & assembly instructions and parts guides are available from the Factory or Rexnord Account Executive. When requesting information, please give complete data from the nameplate on the gear drive; Model, M.O.Number, Date, RPM, and Ratio.

***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

WARRANTY — Rexnord Industries (the "Company") warrants that, for a period of three years from the date of shipment, the product described herein will deliver successfully its rated output as indicated on the nameplate, provided, it is properly installed and maintained, correctly lubricated, and operated in the environment and within the limits of speed, torque or other load conditions for which it was sold. Such product is expressly not warranted against failure or unsatisfactory operation resulting from dynamic vibrations imposed upon it by the drive system in which it is installed unless the nature of such vibrations has been fully defined and expressly accepted in writing by the Company as a condition of operation.


Type A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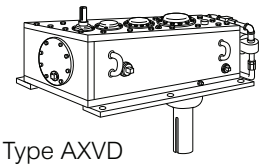
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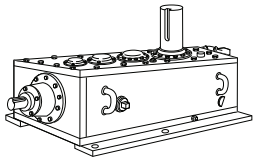
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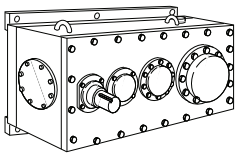
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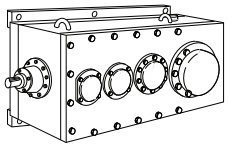
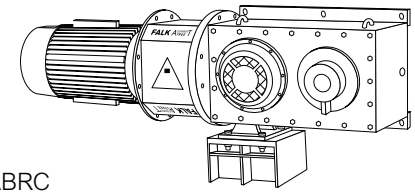

Type ABR


Type ABRC

INSTALLATION INSTRUCTIONS

The following instructions apply to standard Falk Type A, AB, AXV, ABX, AR, ABR, & ABRC (Alignment Free) drives. If a drive is furnished with special features, refer to the supplementary instructions shipped with the drive.

NOTE: Quadruple Reduction Type "A" Gear Drives:

Removal of backstop and mounting bracket may be required for adequate clearance when installing foundation fasteners. Removal of fan assemblies may be required for adequate clearance when installing foundation fasteners.

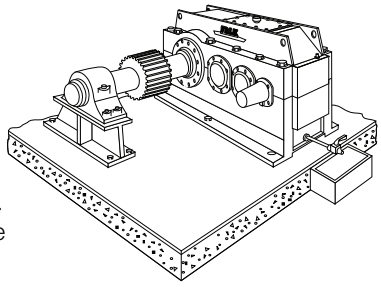
WELDING — Do not weld on the gear drive or accessories without prior approval from Rexnord Industries, LLC. Welding on the drive may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval could void the warranty.

EFFECTS OF SOLAR ENERGY — If the gear drive operates in the sun at ambient temperatures over 100°F(38°C), 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.

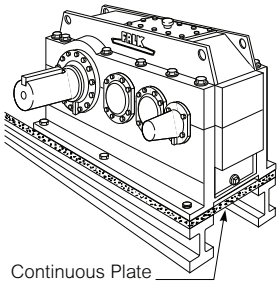
MOUNTING POSITION — Standard mounting positions for types A, AB, , and ABX are with the base horizontal, and for types AR, ABR, and ABRC with the input and output shafts horizontal. If a gear drive is ordered for non-standard mounting positions, refer to the instructions provided with the drive for oil levels and bearing lubrication. If it is necessary to mount the gear drive in a different position from which it was ordered, refer to Falk for required changes to provide proper lubrication.

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

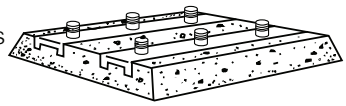
When an outboard bearing is used, mount drive and outboard bearing on a continuous foundation or bedplate, and dowel both in place.



FOUNDATION, STEEL — When mounting gear drive on structural steel, it is recommended that an engineered design be utilized for a pedestal, adapter base or bed to provide sufficient rigidity, to prevent induced loads from distorting the housing and causing gear misalignment. In the absence of an engineered design, it is recommended that a base plate, with thickness equal to or greater than the thickness of the drive feet, be securely bolted to steel supports and extend under the entire 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 4 for coupling alignment instructions.

MOTOR BRACKETS — Falk motor brackets provide an economical “soft mounting” for standard NEMA and IEC foot mounted AC induction electric motors. The weight, location, and starting torque of the motor will cause cantilevered motor brackets to deflect downward or to twist to varying degrees.

The motor bracket/motor selections are engineered to be within acceptable deflection limits as determined by Rexnord.. Because the bracket is a “soft motor support”, deflection and vibration magnitude of the bracket may exceed levels normally considered acceptable for rigidly mounted machinery.

For applications using other than standard selections, use of a motor plate is recommended. If a motor bracket is to be used, it becomes the customer’s responsibility to support the rear of the motor bracket to limit deflection and vibration to within satisfactory levels as determined by the customer.

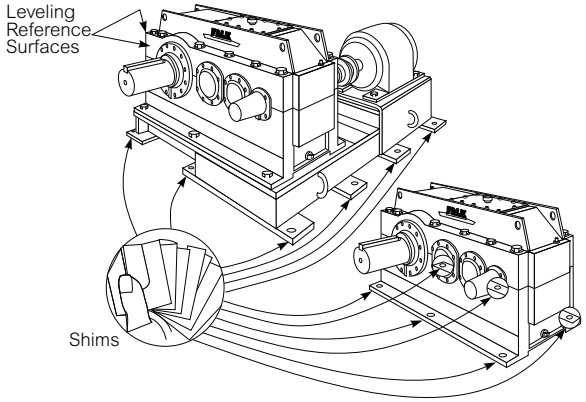
GEAR DRIVE ALIGNMENT

FOOT MOUNTED DRIVES – Align drive with driven equipment by placing broad, flat shims under all mounting pads. 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 4 for coupling alignment.

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

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

SHAFT MOUNTED DRIVES — Shaft mounted drive alignment occurs when the gear drive is attached to the driven shaft. The standard hollow low speed shaft is connected to the driven shaft with a shrink disc connection. Solid low speed shafts are typically connected with an MCF moment type coupling. Refer to the Shaft Connection section for coupling installation.



There may be some visible movement of the drive while operating due to shaft and coupling . Torque arm assemblies must be aligned such that the gear drive movement is not restricted during operation. Refer to torque arm instructions on Page 3.

The Alignment Free drive flange motor adapter provides registration for the motor which eliminates the adjustments normally required for high speed coupling alignment.

TORQUE ARMS

The torque arm connects a shaft mounted gearbox to the foundation. In static condition, it helps to support the weight of the gearbox/motor assembly. In the dynamic condition, it supports the weight and also transmits the torque reaction to the foundation. The torque arm may be loaded in compression or tension. Maximum torque arm loads should be considered when designing the foundation for the torque arm anchor.

TORQUE ARM ASSEMBLY — The torque arm components are to be assembled according to the following illustration. A plain spherical bearing is fitted

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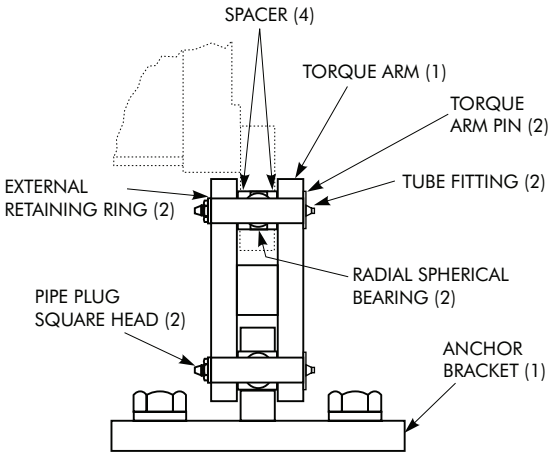
into the gearbox housing or bedplate. A pin engages the spherical bearing and connects it to the torque arm. Spacers center the bearing on the pin. The pin is retained by a snap ring. A similar connection is made between the torque arm and anchor bracket. In operation, the torque arm is to be perpendicular to the edge of the gear drive.

WARNING: *Angular misalignment of the torque arm may restrict gear drive gear drive movement and cause excessive loading on the low speed shaft and driven equipment.*

TORQUE ARM MOVEMENT — Movement of the gear drive while operating is natural. The movement is due to shaft and coupling runouts. The standard torque arm is designed to accommodate this movement. It allows the



gearbox to move slightly with the driven shaft. This prevents transmitting unnecessary additional loads to the driven shaft through the gearbox. DO NOT restrain free movement of the gear drive, to do so will adversely load the low speed shaft and driven shaft and may result in shaft or hub failure. Recheck torque arm movement during regular maintenance intervals.

SHAFT CONNECTIONS

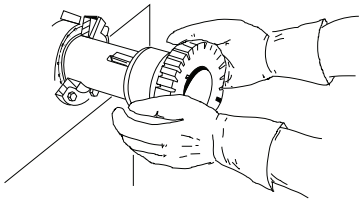
WARNING: *Provide suitable guards in accordance with local and national standards.*

SHRINK DISC CONNECTIONS — Shrink disc assemblies used on hollow low speed shafts and on some MCF coupling hubs require special installation procedures. Refer to the following Falk bulletins for detailed instructions:

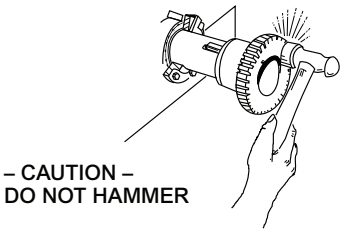
Shrink Discs 138-850

MCF couplings 458-862

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 275°F (135°C) and slide onto gear drive shaft.



– CAUTION –
DO NOT HAMMER

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.

FLANGED MOTOR ADAPTERS — Accurate axial positioning of the coupling hub on the motor shaft is required to ensure proper coupling gap. To establish the correct overhang on the motor shaft, measurements are required. Refer to Figure 1 below. First measure the distance from the motor mounting face of the motor to the end of the motor shaft (A). Then measure the distance from the motor mounting face of the motor adapter to the face of the gear drive hub (B). Refer to the coupling installation and maintenance instructions to determine the desired coupling gap. The coupling overhang is determined from the following equation:

Overhang=A+Gap-B

If the calculated overhang is a positive value, the motor shaft extends beyond the hub by that amount.

NOTE: For couplings where the coupling gap does not occur at the end of the motor hub, an additional adjustment must be made. See dimension C in Figure 1 below.

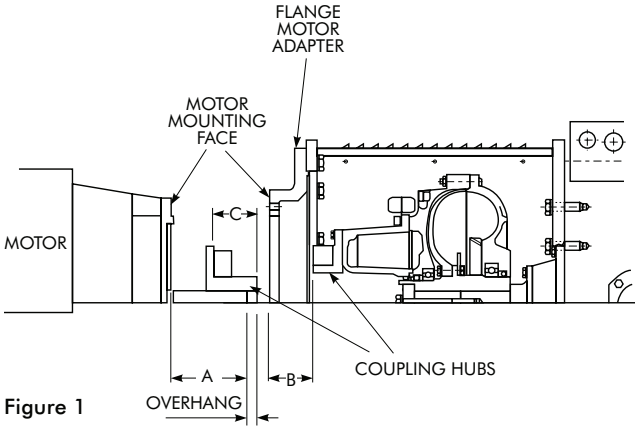


Figure 1

FALK COUPLINGS — (Except fluid type) Detailed installation manuals are available from Rexnord, your local Rexnord Account Executive 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.

Flanged Type Rigid Couplings are typically used on drives with vertical output shafts. The low speed shaft extension ends of the solid vertical shaft drives are drilled and tapped to accommodate coupling keeper plates. Tightening torques for fasteners, including keeper plate fasteners are listed in Table 1, Page 5.

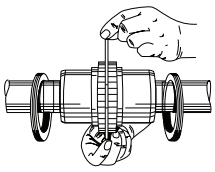
FALK FLUID COUPLINGS — Refer to the installation manual furnished with the Falk fluid coupling for installation and startup instructions.

Type ABRC — The Alignment Free flange motor adapter has two side inspection openings. On solid shaft gear drives, the opening opposite the low speed shaft extension

has been marked to indicate the vertical midpoint of the adapter. On hollow shaft gear drives, the opening on the shrink disk side of the gear drive has been marked to indicate the vertical midpoint of the adapter. These marks are used to establish the proper fill angle for the fluid coupling.

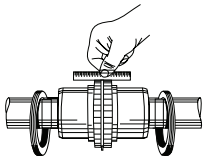
The fluid coupling outside diameter has been marked with two separate match marks. The recommended fill can be obtained by lining up the correct match mark on the fluid coupling with the mark in the inspection opening and filling the fluid coupling until fluid appears at the lip of the fill hole. To determine the correct mark on the fluid coupling begin by aligning the fill hole with the match mark in the inspection opening. For fill angles less than 90°, rotate the fill plug upward till the match marks line up. For fill angles greater than 90°, rotate the fill plug downward till the match marks line up.

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



Steelflex® Illustrated

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



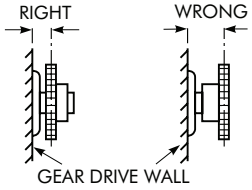
Steelflex Illustrated

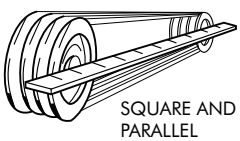
SPROCKETS, PULLEYS OR SHEAVES — Mount power take-offs as close to the gear drive housing as possible to avoid undue bearing load and shaft deflection.

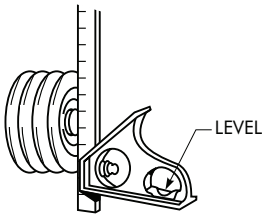
Align the output shaft of the gear drive square and parallel with the driven shaft by placing a straightedge across the face of the sprockets or sheaves as illustrated.Check horizontal shaft alignment by placing one leg of a square against the face of the sheave or sprocket with the spirit level on the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

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

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







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

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

NON FALK COUPLINGS — Refer to manufacturer's 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 for all types except ABRC. For type ABRC drives, remove the backstop before electrically connecting the motor. AB, ABR, and ABRC backstops are held in place by a retaining ring on the intermediate shaft.

After completing electrical connections, check motor and gear drive shaft rotations. If rotations are correct, complete alignment and assembly of coupling or re-install the backstop.

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FASTENER TIGHTENING TORQUES

Use the tightening torque values specified in Table 1 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 or soft gaskets or vibration dampeners on the mounting surface. If the tightening torque exceeds the capacity of the torque wrench, use a torque multiplier. For inch fasteners, use Grade 5 for diameters though 1.500 inch and ASTM A 354 grade BC for larger diameter fasteners. Use ISO property class 8.8 for metric fasteners.

TABLE 1 — Tightening Torques: +/-5%
DO NOT Lubricate Fasteners

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

TABLE 1A — Tightening Torques: +/-5%
DO NOT Lubricate Fasteners

Metric Fasteners – Property Class 8.8				
Fastener Size	Metal to Metal		Metal to Concrete	
	lb-ft	Nm	lb-ft	Nm
M4 x .7	2	3	1.5	2
M5 x .8	4.5	6	3.5	5
M6 x 1.0	7.5	10	6	8
M8 x 1.25	18	24	14	19
M10 x 1.5	36	50	29	39
M12 x 1.75	62	84	50	68
M16 x 2	56	210	126	170
M20 x 2.5	305	415	246	330
M30 x 3.5	1060	1 440	850	1 150
M36 x 4	1680	2 520	1500	2 030
M42 x 4.5	3000	4 050	2400	3 250
M48 x 5	4500	6 100	3600	4 880
M56 x 5.5	7300	9 850	5800	7 860

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.

INTERNAL COOLING TUBES — Refer to Manual 138-310 for installation, operation, and maintenance of internal cooling tubes.

Lubrication Recommendations

INTRODUCTION

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

Lubricants listed in this manual are typical products ONLY and should not be construed as exclusive recommendations. Industrial type petroleum-based rust and oxidation inhibited (R & O), industrial type extreme pressure (EP) or industrial type micropitting resistant gear lubricants are the recommended gear lubricants. 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 3 or 4 for proper lubricant viscosity grade based on ambient temperature range. See Falk GMax 6000 paragraph on this page for ambient air temperature range if using this lubricant.
2. Refer to Table 2 for summary of lubricant type.
3. Using proper lubricant table and viscosity grade, select desired lubricant manufacturer name.
4. Refer to Table 9 or 10 for approximate oil capacity to purchase.

TABLE 2 — Summary of Lubricant Type and Greases

Petroleum-Based		
R & O Inhibited See Table 6A	Extreme Pressure (EP) See Table 6B	Micropitting Resistant See Table 6C
Synthetic Lubricant, Polyalphaolefin Type (PAO)		
R & O Inhibited See Table 7A	Extreme Pressure (EP) See Table 7B	Micropitting Resistant See Table 7C
Synthetic Lubricant, Polyalkylene Glycol Type (PAG)		
See Falk GMax 6000 (Paragraph to Right)		
Conventional Grease		
See Table 8		
Food Grade Lubricant & Grease		
See Page 14		

VISCOSITY (IMPORTANT)

The proper viscosity grade for petroleum-based lubricant is found in Table 3. For synthetic lubricant viscosity grades, refer to Table 4 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.

If a gear drive operates in a typical indoor environment where the ambient temperature is within 70°F to 125°F (21°C to 52°C), the oil viscosity may be increased one ISO grade above that shown for the 50°F to 125°F (10°C to 52°C) range. That is, an ISO VG 320 (AGMA 6) or ISO VG 460 (AGMA 7) may be substituted for an ISO VG 220 (AGMA 5) or ISO VG 320 (AGMA 6) respectively, under this ambient condition.

LUBRICANT TYPES

PETROLEUM-BASED LUBRICANTS (TABLES 6A, 6B & 6C) — Industrial type petroleum-based rust and oxidation inhibited (R & O) gear lubricants are the most common and readily available general purpose gear lubricants.

SYNTHETIC LUBRICANTS (TABLES 7A, 7B & 7C) — Synthetic lubricants of the polyalphaolefin (PAO) type 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 lubricant is given in Table 4.

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.*

Falk GMax 6000 – Rexnord markets Falk GMax 6000, a polyalkylene glycol lubricant. It is available in ISO VG 135 and covers ambient air temperature range -30° to +125°F (-34° to +52°C).

WARNING*: GMax 6000 is 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 GMax 6000. Do not use GMax 6000 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. GMax 6000 is not compatible with polycarbonate sight glass. Use glass sight glass.*

ANTI-WEAR (AW) LUBRICANTS — For moderately loaded gear drives or operating conditions challenging for conventional R & O oils, industrial type anti-wear (AW) lubricants are suggested. These lubricants contain anti-wear additives that provide stronger thicker lubricant film to help maintain surface separation. Synthetic lubricants by inherent nature of base stock properties provide anti-wear performance.

EXTREME PRESSURE (EP) LUBRICANTS (TABLES 6B & 7B) — For highly loaded drives or for drives loaded in excess of original estimates, industrial-type petroleum EP lubricants are preferred. EP lubricants are manufactured from petroleum or synthetic base lubricants. Anti-scuff is another term used to describe EP lubricants.

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MICROPITTING RESISTANT LUBRICANTS (TABLES 6C & 7C) — 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. Highly loaded gear drives or applications where operating loads are not well defined may benefit from this type of lubricant. 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 3 provides viscosity grade selections for petroleum-based lubricants. See Table 4 for synthetic lubricants.

OIL LEVELS

Types A & AB Prior to filling gear drive or after storage, remove the inspection cover and flood the oil troughs with oil. The oil troughs sit directly beneath the inspection cover and can be filled to flooding, typically with a volume of approximately 10% of the sump lube. This will provide oil to the bearings. Fill the drive with oil to the level indicated on the oil dipstick. The approximate oil capacity is given on the gear drive nameplate. For reference, approximate capacities are also given in Table 9. Always fill to proper level indicated on the dipstick.

For drives that have been inactive for greater than 1 month, remove the inspection cover and flood the oil troughs with oil. The oil troughs sit directly beneath the inspection cover and can be filled to flooding. This will ensure proper lubrication of the bearings. After filling the unit and before starting, ensure that the oil levels do not exceed those on the dipstick. Always fill to proper level indicated on the dipstick.

Types ABR, ABRC, and AR Fill the drive with oil to the level indicated on the oil dipstick. Approximate oil capacities are given on the nameplate and in Table 10.

TABLE 3 — Viscosity Grade Recommendations For All Petroleum Lubricants

Output RPM	Ambient Temperature Range			
	+15° to +60°F (–9° to +16°C)		+50° to +125°F (+10° to +52°C)	
	ISO-VG	AGMA	ISO-VG	AGMA
Below 80	150	4	320	6
80 & Above	150	4	220	5

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump, cold temperature oil viscosity is important. Lubricant viscosity at start-up generally should not exceed 1725 cSt (8,000 SSU). When exceeding this viscosity, pump cavitation is possible, preventing oil circulation. A sump heater may be required or it may be possible to use a lower viscosity oil to minimize pump cavitation.

Drives with Oil Pumps Types AXV and occasionally other types of gear drives will be equipped with oil pumps for cooling or special lubrication considerations. If a drive is equipped with an oil pump, fill the drive to the level marked on the dipstick. Run the lubrication system for several minutes to fill the system components. Verify that the pump is circulating oil properly, then recheck oil level. If necessary, add oil to compensate for filter and/or cooler.

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

LUBRICATION SYSTEMS

SPLASH LUBRICATED DRIVES — Standard type A, AR, AB, ABR, and ABRC drives are splash lubricated. The lubricant is picked up by the revolving elements and distributed to the bearings and gear meshes.

OIL PUMP LUBRICATED DRIVES — Types AXV and ABX are equipped with an external oil pump to provide oil to the upper bearings and gear meshes. The system is composed of an electric motor driven gear pump, oil filter, flow indicator with switch, and an internal distribution network with relief valve (set at 30 psi). The pump system may be furnished with a 50 or 60Hz, 3 phase electrical motors based on the selection. Refer to the pump motor nameplate and Table 5 for electrical requirements. Wire the motor for correct rotation as indicated by the rotation arrow. The flow indicator has a single pole, double throw switch rated at 15A, 125V/7A, 250V maximum. Connect the flow indicator switch with the prime mover control circuitry to prevent drive operation without the lubrication system.

TABLE 5 — Oil Pump Electrical Specifications

DRIVE SIZE	405 & 425		445-485		505-535	
HP	1		2		3	
Cycles, Hz	50	60	50	60	50	60
RPM	1425	1725	1425	1725	1425	1725
Voltage	220/380/440	208-230/460	220/380/440	208-230/460	220/380/440	208-230/460

Other types of gear drives may also be equipped with oil pumps for special lubrication considerations or external cooling.

CAUTION: *Refer to Factory for drives that use pumps to distribute lubricants with temperatures below 30°F (-1°C).*

TABLE 4 — Viscosity Grade Recommendations for All Synthetic Lubricants

Output RPM	Cold Climates				Normal Climates					
	–30° to +10°F (–34° to –12°C)		–15° to +50°F (–26° to +10°C)		0° to +80°F (–18° to +27°C)		+10° to +125°F (–12° to +52°C)		+20° to +125°F (–7° to +52°C)	
	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA
Below 80	32	0	68	2	150	4	320	6	320	6
80 & Above	32	0	68	2	150	4	220	5	320	6

PREVENTIVE MAINTENANCE

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Also tighten all external bolts and plugs where necessary. DO NOT readjust 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 old sump oil reaches normal operating temperature. Shut down drive and drain immediately.
2. Immediately flush drive with an oil of the same type and viscosity grade as the original charge (warmed to approximately 100°F (38°C) in cold weather) by rapidly pouring or pumping a charge equal to 25 -100% of the initial fill volume or until clean oil flows through the drain.
3. Close the drain and refill the drive to the correct level with new oil of the correct type and viscosity.

PERIODICALLY —

1. Check the oil level of the drive when it is stopped and at ambient temperature. Add oil if needed. If the oil level is ABOVE the high oil level mark on the dipstick, have the oil analyzed for water content. Moisture in the oil may indicate that a seal or the heat exchanger is leaking. If so, replace the defective part immediately and change the oil. DO NOT fill above the mark indicated as leakage or undue heating may result.
2. Check coupling alignment to make certain that foundation settling has not caused excessive misalignment.
3. If drive is equipped with a fan, periodically clean accumulated foreign matter from the fan, guard, and deflector.
4. If drive is equipped with a torque arm, check for free movement.
5. Purge grease from grease lubricated seals **WITH HAND GREASE GUN**. Regrease those bearings requiring grease lubrication.

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.

Guidelines for when to change Falk GMax 6000 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.

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TABLE 6A —Petroleum Based R & O (Rust & Oxidation) Inhibited Lubricants ▲

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

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	Hyspin AWS 150 Castrol Paradene R&O 150 Castrol Paradene AW 150	Hyspin AWS 220 Castrol Paradene R&O 220 Castrol Paradene AW 220	- - - Castrol Paradene R&O 320 Castrol Paradene AW 320
Chevron / Texaco / Caltex	Rando HD 150	Rando HD 220	Rando HD 320
Citgo Petroleum Corp.	Pacemaker T 150	Pacemaker SD 220	Pacemaker SD 320
Exxon Mobil / Esso	DTE Oil Extra Heavy Vacuoline 528	DTE Oil BB Vacuoline 533	DTE Oil AA Vacuoline 537
Petro-Canada Lubricants	TurboFlo R&O 150	TurboFlo R&O 220	TurboFlo R&O 320
Phillips 66 / Conoco / 76 Lubricants / Kendall	Multipurpose R&O 150	Multipurpose R&O 220	Multipurpose R&O 320
Shell Oil Co.	Morlina S2 B 150 Morlina S2 BA 150	Morlina S2 B 220 Morlina S2 BA 220	Morlina S2 B 320 Morlina S2 BA 320
Total Lubricants USA / Keystone Div. Penwalt Corp.	Cirkan ZS 150	Cirkan ZS 220	Cirkan ZS 320
Whitmore Manufacturing Company	Hyperion 150	Hyperion 220	Hyperion 320

▲ Minimum viscosity index of 90.
■ Kinematic viscosity in units of mm^2/s is equivalent to cSt (centistokes).

TABLE 6B — Petroleum Based EP (Extreme Pressure) Lubricants ▲

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

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	Alpha SP 150	Alpha SP 220	Alpha SP 320
Chevron / Texaco / Caltex	Meropa 150 Ultra Gear 150	Meropa 220 Ultra Gear 220	Meropa 320 Ultra Gear 320
Citgo Petroleum Corp.	EP Compound 150	EP Compound 220	EP Compound 320
Exxon Mobil / Esso	Mobilgear 600 XP 150	Mobilgear 600 XP 220	Mobilgear 600 XP 320
Fuchs Lubricants Company	- - -	GearMaster CLP Oils 220	- - -
Kluber Lubrication	Kluberoil GEM 1 N 150	- - -	- - -
Petro-Canada Lubricants	Enduratex EP 150	Enduratex EP 220	Enduratex EP 320
Phillips 66 / Conoco / 76 Lubricants / Kendall	Extra Duty Gear Oil 150	Extra Duty Gear Oil 220	Extra Duty Gear Oil 320
Shell Oil Co.	Omala S2 G 150	Omala S2 G 220	Omala S2 G 320
Total Lubricants USA / Keystone Div. Penwalt Corp.	Carter EP 150	Carter EP 220	Carter EP 320

▲ Minimum viscosity index of 90.
■ Kinematic viscosity in units of mm^2/s is equivalent to cSt (centistokes).

TABLE 6C — Petroleum Based Micropitting Resistant Lubricants ▲

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

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**
Kluber Lubrication	- - -	Kluberoil GEM 1 N 220	Kluberoil GEM 1 N 320

▲ Minimum viscosity index of 90.
■ Kinematic viscosity in units of mm^2/s is equivalent to cSt (centistokes).

TABLE 7A — Synthetic PAO (Polyalphaolefin) R & O (Rust & Oxidation) Inhibited Lubricants ▲

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ■	28.8-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**
Castrol Industrial Lubricants	Alphasyn T 32 Castrol Isolube 32	Alphasyn T 68 Castrol Isolube 68	Alphasyn T 150 Castrol Isolube 150	Alphasyn T 220 Castrol Isolube 220	Alphasyn T 320 Castrol Isolube 320
Chevron / Texaco / Caltex	Cetus HiPerSYN Oil 32	Cetus HiPerSYN Oil 68	Cetus HiPerSYN Oil 150	Cetus HiPerSYN Oil 220	Cetus HiPerSYN Oil 320
Citgo Petroleum Corp.	- - -	CITGEAR Synthetic HT 68	CITGEAR Synthetic HT 150	CITGEAR Synthetic HT 220	CITGEAR Synthetic HT 320
Exxon Mobil / Esso	Mobil SHC 624	Mobil SHC 626	Mobil SHC 629	Mobil SHC 630	Mobil SHC 632
Kluber Lubrication	- - -	Klubersynth G 4 68	Klubersynth G 4 150	Klubersynth G 4 220	- - -
Petro-Canada Lubricants	Synduro SHB 32	Synduro SHB 68	Synduro SHB 150	Synduro SHB 220	- - -
Phillips 66 / Conoco / 76 Lubricants / Kendall	- - -	Syncon R&O 68	Syncon R&O 150 ●	Syncon R&O 220 ●	Syncon R&O 320 ●
Shell Oil Co.	- - -	Morlina S4 B 68	Morlina S4 B 150	Morlina S4 B 220	Morlina S4 B 320

▲ Minimum viscosity index of 130. Consult lubricant supplier/manufacturer for maximum operating temperature.
■ Kinematic viscosity in units of mm^2/s is equivalent to cSt (centistokes).
● Minimum viscosity index of 120.

TABLE 7B — Synthetic PAO (Polyalphaolefin) EP (Extreme Pressure) Lubricants ▲

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ■	28.8-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**
Castrol Industrial Lubricants	- - -	- - - Castrol Isolube EP 68	Alphasyn EP 150 Castrol Isolube EP 150	Alphasyn EP 220 Castrol Isolube EP 220	Alphasyn EP 320 Castrol Isolube EP 320
Chevron / Texaco / Caltex	- - -	- - -	Tegra Synthetic Gear Lubricant 150	Tegra Synthetic Gear Lubricant 220	Tegra Synthetic Gear Lubricant 320
Citgo Petroleum Corp.	- - -	CITGEAR Synthetic EP Gear 68	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 68	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 mm^2/s is equivalent to cSt (centistokes).

TABLE 7C — Synthetic PAO (Polyalphaolefin) Micropitting Resistant Lubricants ▲

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ■	28.8-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**
Chevron / Texaco / Caltex	- - -	- - -	- - -	- - -	Pinnacle WM 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 mm^2/s is equivalent to cSt (centistokes).

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PETROLEUM LUBRICANTS — 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 3. Lubricant suppliers can test oil from the drive periodically and recommend economical change schedules.

SYNTHETIC LUBRICANTS — 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 5.

Falk GMax 6000 change interval can be up to 15,000 hours. It has broad temperature range so seasonal oil changes are generally not needed. The condition of GMax must be monitored to maintain lubricant properties and cleanliness.

GREASE-LUBRICATED SEALS AND BEARINGS

All drives and some backstops are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts. Some vertical shaft and specially mounted drives have grease lubricated bearings. Drives are shipped with NLGI #2 grade grease in the seal housing cavities unless otherwise specified.

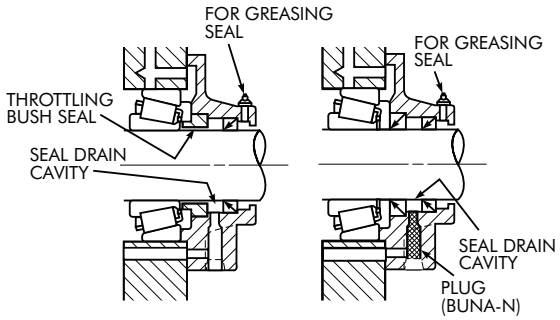
Whenever changing oil in the drive, purge the seals with one of the NLGI #2 grade greases listed in Table 8.

Depending upon the degree of contamination, periodically (at least every six months), purge contaminated grease from seals by slowly pumping fresh bearing grease through the seal, **WITH HAND GREASE GUN,** until fresh grease flows out along the shaft. Wipe off purged grease.

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

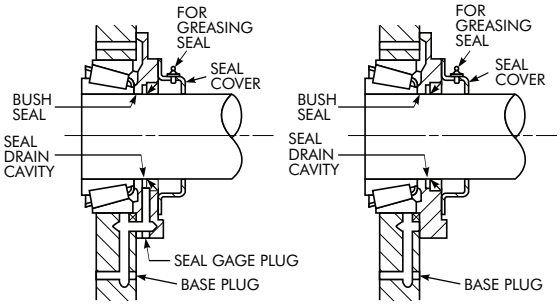
WARNING: *Greases in Table 8 contain harmful substances not allowed in the food processing industry. If grease could contaminate the product, as in the food and drug industries, the grease originally supplied with gear drive must be removed and replaced with grease listed in Table 19. Simply purging grease with grease gun will not remove all grease and cross-contamination will likely occur. Remove end cover and manually remove grease. Grease registered as H1 by NSF, National Sanitation Foundation, is suitable for food processing applications.*

TYPICAL SEAL ASSEMBLIES



LOW OIL LEVEL
Sizes 385 & 405 thru 585
Inner Bush Seal and Outer Lip Type Seal

HIGH OIL LEVEL
Sizes 385 & 405 thru 585
Two Lip Type Oil Seals



LOW OIL LEVEL
Sizes 305 thru 365 & 395
Inner Bush Seal and Outer Lip Type Seal

HIGH OIL LEVEL
Sizes 305 thru 365 & 395
Inner Bush Seal and Outer Lip Type Seal

TABLE 8 — Conventional NLGI #2 Grade Grease▲ for Grease Lubricated Bearings & Grease Purged Seals

0° to +200°F (-18° to +93°C)

Manufacturer	EP Grease ■
Chevron / Texaco / Caltex	Multifak EP 2
Citgo Petroleum Corp.	Lithoplex RT 2 Premium Lithium EP 2
ExxonMobil / Esso	Mobilith SHC 460 ● Mobilux EP 2
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 EP 2

▲ Not suitable for food grade applications.
■ Caution: Do not use EP grease in backstop seals.
● High performance synthetic alternate.

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

GREASE LUBRICATED BEARINGS (TYPES AXV AND ABX) — All hollow and most solid vertical low speed shaft drives have a grease lubricated lower low speed bearing. The bearing is lubricated at the factory with an NLGI #2 grade grease. Grease bearing during oil changes or at intervals of every 6 months or 2500 hours of operation whichever is less. Refer to Table 8 for NLGI #2 grade greases. Table 11 contains low speed bearing grease capacities.

Remove the pressure relief plug before greasing. Pump grease into bearing cage until fresh grease appears at the plug. Replace the pressure relief plug when finished. See Figure 2 below.

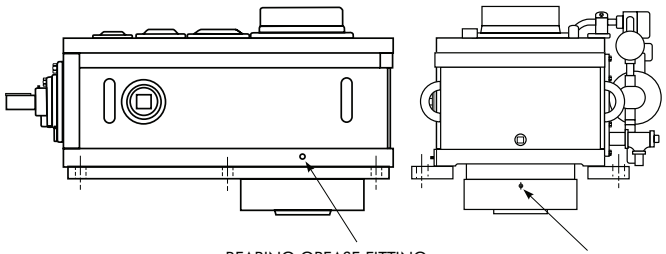


Figure 2

BACKSTOPS — For types AB, ABR, and ABX model C and later, backstops are furnished filled with oil. Remove plug from top of backstop and replace with vent wired to torque arm. Refer to the supplemental backstop installation and maintenance instructions provided with the drive for recommended lubricants. It is recommended to lubricate backstops during regular drive lubrication intervals. Earlier models had backstops that are grease lubricated, do not use greases with molybdenum disulfide or other EP additives.

Type "A" and "AR" drives may have a Falk pawl type backstop or a **Falk PRT** wedge ramp type backstop. Falk pawl backstops are prelubricated and sealed at assembly and require no future lubrication. These backstops also contain grease purgeable seals (see paragraph above for grease lubricated seals).

Falk PRT backstops are shipped filled with oil. Remove plug from top of backstop and replace with vent wired to torque arm. Follow lubrication recommendations as outlined in the supplemental backstop instructions furnished with the drive.

TABLE 9 — Types A & AB Approximate Oil Capacities ‡

DRIVE SIZE	Type A								Type AB						DRIVE SIZE
	A1		A2		A3		A4		AB2		AB3		AB4		
	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	
305	3	11	4	15	4	15									**305**
325	5	19	6	23	6	23									**325**
345	6	23	8	30	9	34									**345**
365	10	38	13	49	13	49									**365**
385	10	38	10	38	10	38	10	38	11	42	11	42	11	42	**385**
395	12	45	16	61	17	64									**395**
405	10	38	15	57	15	57	14	53	11	42	15	57	15	57	**425**
425	14	53	20	76	21	79	20	76	14	53	20	76	22	83	**405**
445	22	83	22	83	29	110	28	106	22	83	29	110	30	114	**445**
465	29	110	30	114	39	148	38	144	30	114	39	148	39	148	**465**
485	32	121	38	144	57	216	56	212	31	117	52	197	58	220	**485**
505	42	159	50	189	78	295	77	291	39	148	70	265	80	303	**505**
525	53	201	59	223	95	360	93	352	48	182	87	329	100	379	**525**
545	...	...	115	435	135	511	...	...	...	...	111	420	138	522	**545**
565	...	...	130	492	160	606	...	...	...	...	142	538	170	644	**565**
585	...	...	215	814	250	946	...	...	...	...	220	833	275	1 041	**585**

‡ Capacities vary with ratio, speed and type of cooling. Follow values on the gear drive nameplate. Always fill to proper level indicated on the dipstick.

TABLE 10 — Types AR, AVX, ABR, and ABX Approximate Oil Capacities

DRIVE SIZE	Vertical Output				Horizontal Output				DRIVE SIZE
	ABX3 & AXV2		ABX4, AXV3, & AXV4		ABR3 & AR2		ABR4, AR3, & AR4 ★		
	Gallons	Liters	Gallons	Liters	Gallons	Liters	Gallons	Liters	
405	10	38	10	38	14	53	14/18	53/68	**405**
425	15	57	15	57	19	72	19/27	72/102	**425**
445	25	95	25	95	35	132	35/50	132/189	**445**
465	30	114	30	114	40	151	40/55	151/208	**465**
485	40	151	45	170	50	189	60/80	227/303	**485**
505	50	189	60	227	65	246	80/100	303/379	**505**
535	70	265	80	303	95	360	110/140	416/530	**535**
555	100	379	120	454	130	492	160/220	606/833	**555**

★ Values to right of slash mark are for type AR4 drives when HS Shaft is above drive center line.

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TABLE 11 — Types AXV and ABX – LS Shaft Lower Bearing Grease Capacity

DRIVE SIZE	Solid Shaft				Hollow Shaft		DRIVE SIZE
	Down		Up		oz	mL	
	oz	mL	oz	mL			
405	8	237	12	355	12	355	**405**
425	12	355	18	532	12	355	**425**
445	12	355	18	532	24	710	**445**
465	30	890	40	1180	30	890	**465**
485	30	890	40	1180	60	1770	**485**
505	40	1180	50	1480	60	1770	**505**
535	50	1480	50	1480	80	2370	**535**
555	50	1480	60	1770	80	2370	**555**

STORED & INACTIVE GEAR DRIVES

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

CAUTION: *Drives are not to be stored outdoors without shelter. Standing water on drives significantly increases risk of water ingression and rust. Installer assumes risk.*

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 the manual. Refer to manual 128-014 for "Start-up after Storage" instructions.

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

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

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	Oil Capacity Gallons	NOX-RUST VCI-10		
		2% of Sump Capacity Gallons	2% of Sump Capacity Quarts	2% of Sump Capacity Ounces
305	6	0.12	0.5	15.4
325	8	0.17	0.7	21.1
345	13	0.26	1.0	33.3
365	17	0.34	1.4	43.5
385	11	0.22	0.9	28.2
405	15	0.30	1.2	38.4
425	22	0.44	1.8	56.3
445	30	0.60	2.4	76.8
465	39	0.78	3.1	99.8
485	58	1.16	4.6	148.5
505	80	1.60	6.4	204.8
525	100	2.00	8.0	256.0
545	138	2.76	11.0	353.3
565	170	3.40	13.6	435.2
585	275	5.50	22.0	704.0

▲ Product of Daubert Chemical Company, Chicago, IL.

FOOD GRADE LUBRICANTS

Guidance for selecting petroleum-based and synthetic-based food grade lubricants are shown below in Table 13. For general lubrication guidlines, refer to the first part of the "Lubrication Recomendation" Section.

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 Table Table 9 or 10 for approximate oil capacity to purchase.

TABLE 13 — Summary of Food Grade Lubricants and Greases

Petroleum-Based	
R & O Inhibited See Table 16A	Extreme Pressure (EP) See Table 16B
Synthetic Lubricant, Polyalphaolefin Type (PAO)	
R & O Inhibited See Table 17A	Extreme Pressure (EP) See Table 17B
Synthetic Lubricant, Polyalkylene Glycol Type (PAG)	
Extreme Pressure (EP) See Table 18	
Food Grade Grease	
See Table 19	

OIL PUMPS — When selecting a lubricant for a gear drive equipped with an oil pump, cold temperature oil viscosity is important. Lubricant viscosity at start-up generally should not exceed 1725 cSt (8,000 SSU). When exceeding this viscosity, pump cavitation is possible, preventing oil circulation. A sump heater may be required or it may be possible to use a lower viscosity oil to minimize pump cavitation.

FOOD GRADE LUBRICANTS (TABLES 16A, 16B, 17A, 17B, 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 16A, 16B, 17A, 17B, 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.

TABLE 14 — Viscosity Grade Recommendations For All Food Grade Petroleum-Based Lubricants

Output RPM	Ambient Temperature Range			
	+15° to +60°F (–9° to +16°C)		+50° to +125°F (+10° to +52°C)	
	ISO-VG	AGMA	ISO-VG	AGMA
Below 80	150	4	320	6
80 & Above	150	4	220	5

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 15 — Viscosity Grade Recommendations For Food Grade Synthetic Lubricants

Output RPM	Cold Climates				Normal Climates					
	–30° to +10°F (–34° to –12°C)		–15° to +50°F (–26° to +10°C)		0° to +80°F (–18° to +27°C)		+10° to +125°F (–12° to +52°C)		+20° to +125°F (–7° to +52°C)	
	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA
Below 80	32	0	68	2	150	4	320	6	320	6
80 & Above	32	0	68	2	150	4	220	5	320	6

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PREVENTIVE MAINTENANCE

AFTER FIRST WEEK — Check alignment of total system and realign where necessary. Also tighten all external bolts and plugs where necessary. DO NOT readjust 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 old sump oil reaches normal operating temperature. Shut down drive and drain immediately.
2. Immediately flush drive with an oil of the same type and viscosity grade as the original charge (warmed to approximately 100°F (38°C) in cold weather) by rapidly pouring or pumping a charge equal to 25 -100% of the initial fill volume or until clean oil flows through the drain.
3. Close the drain and refill the drive to the correct level with new oil of the correct type and viscosity.

PERIODICALLY —

1. Check the oil level of the drive when it is stopped and at ambient temperature. Add oil if needed. If the oil level is ABOVE the high oil level mark on the dipstick, have the oil analyzed for water content. Moisture in the oil may indicate that a seal or the heat exchanger is leaking. If so, replace the defective part immediately and change the oil. DO NOT fill above the mark indicated as leakage or undue heating may result.
2. Check coupling alignment to make certain that foundation settling has not caused excessive misalignment.
3. If drive is equipped with a fan, periodically clean accumulated foreign matter from the fan, guard, and deflector.
4. If drive is equipped with a torque arm, check for free movement.
5. Refer to Section on Grease-Lubricated Seals and Bearings.

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 ≥4/≥6/≥14 microns, respectively per ISO 4406.

TABLE 16A — Food Grade Petroleum-Based R & O (Rust & Oxidation) Inhibited Lubricants – NSF (National Sanitation Foundation) H1 Registered

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

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**
Bel-Ray Company, Inc.	No-Tox Gear Oil ISO 150	No-Tox Gear Oil ISO 220	No-Tox Gear Oil ISO 320
Kluber Lubrication	Paraliq P 150	---	---
Lubriplate Lubricants Co.	Lubriplate FMO 900-AW	Lubriplate FMO 1100-AW	Lubriplate FMO 1700-AW

▲ Kinematic viscosity in units of mm^2/S is equivalent to cSt (centistokes).

TABLE 16B — Food Grade Petroleum-Based EP (Extreme Pressure) Lubricants – NSF (National Sanitation Foundation) H1 Registered

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

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**
Petro-Canada	Purity FG EP 150	Purity FG EP 220	Purity FG EP 320
Total Lubricants USA, Inc.	Nevastane EP 150	Nevastane EP 220	Nevastane EP 320

▲ Kinematic viscosity in units of mm^2/S is equivalent to cSt (centistokes).

TABLE 17A — Food Grade Synthetic PAO (Polyalphaolefin) R & O (Rust & Oxidation) Inhibited Lubricants – NSF (National Sanitation Foundation) H1 Registered

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

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ▲	28.2-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**
ExxonMobil	Mobil SHC Cibus 32	Mobil SHC Cibus 68	Mobil SHC Cibus 150	Mobil SHC Cibus 220	Mobil SHC Cibus 320
Kluber Lubrication	Kluberoil 4 UH1 N 32	Kluberoil 4 UH1 N 68	Kluberoil 4 UH1 N 150	Kluberoil 4 UH1 N 220	Kluberoil 4 UH1 N 320
Lubriplate Lubricants Co.	Lubriplate SFGO Ultra 32	Lubriplate SFGO Ultra 68	Lubriplate SFGO Ultra 150	Lubriplate SFGO Ultra 220	Lubriplate SFGO Ultra 320
Total Lubricants USA, Inc.	Nevastane SL 32	Nevastane SL 68	Nevastane SL 150	Nevastane SL 220	Nevastane SL 320

▲ Kinematic viscosity in units of mm^2/S is equivalent to cSt (centistokes).

TABLE 17B — Food Grade Synthetic PAO (Polyalphaolefin) EP (Extreme Pressure) Lubricants – NSF (National Sanitation Foundation) H1 Registered

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

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ▲	28.2-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**	**Lubricant Name**
Petro-Canada	---	---	---	Purity FG Synthetic EP 220	---

▲ Kinematic viscosity in units of mm^2/S is equivalent to cSt (centistokes).

TABLE 18 — Food Grade Synthetic PAG (Polyalkylene Glycol) EP (Extreme Pressure) Lubricants – NSF (National Sanitation Foundation) H1 Registered

Maximum operating temperature of lubricants 200°F (93°C)
See Warning Note below.

ISO Viscosity Grade	32	68	150	220	320
AGMA Viscosity Grade	0	2	4	5	6
Viscosity cSt @ 40°C ▲	28.2-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100° F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant Name**	**Lubricant Name**	**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	---	---	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 mm^2/s is equivalent to cSt (centistokes).

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

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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 are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts. Some vertical shaft and specially mounted drives have grease lubricated bearings. Drives are shipped with NLGI #2 grade grease in the seal housing cavities unless otherwise specified.

Whenever changing oil in the drive, purge the seals with one of the NLGI #2 grade greases listed in Table 19. Depending upon the frequency and degree of contamination, purge contaminated grease from seals by slowly pumping fresh bearing grease through the seal, **WITH HAND GREASE GUN,** until fresh grease flows out along the shaft. Wipe off purged grease.

Greases in Table 8 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. Remove end cover and manually remove grease. Grease registered as H1 by NSF, National Sanitation Foundation, is suitable for food processing applications.

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

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

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 20°F (-7°C). If grease must be applied at cooler temperatures consult factory or 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*: Rust preventative oil or vapor-phase 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.*