REVERSE-REDUCTION DRIVES

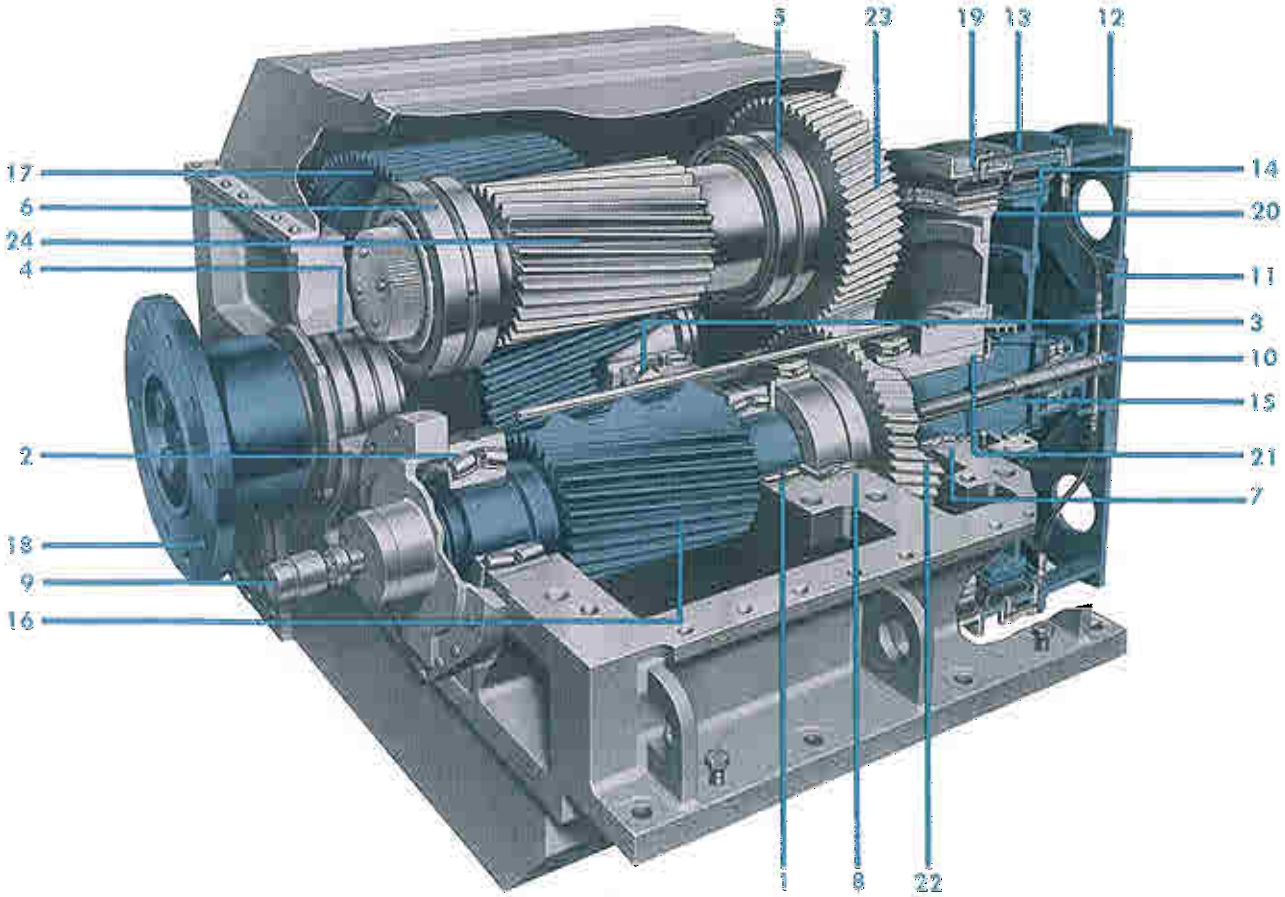
Reverse-reduction is achieved through the clutch assembly spacer (12), ahead clutch (13), and astern clutch (19), which is adapted to and driven by the engine for either ahead or astern operation. Air is supplied selectively to either the ahead or astern clutch as desired through a dual rotary air seal (9) at the aft end of the unit, a separate dual passage air shaft (10) passing through the hollow main ahead pinion shaft (15), and air hoses (11) connecting to the clutch spacer (12) at the forward end.

For ahead rotation (shown in blue in illustration below), the ahead clutch (13), actuated by air, frictionally engages a cylindrical drum (14) mounted on the extended main ahead pinion shaft (15), providing direct single reduction drive through the main gears (16, 17 & 18) from the engine crankshaft to the propeller shaft. The astern clutch (19) is disengaged and the reverse gear train (22, 23 & 24) rotates without load.

For astern rotation, the ahead clutch (13) is released and the astern clutch (19) is engaged with the astern drum (20) mounted on the shaft (21) of the astern drive gear (22), located coaxially with the main ahead pinion shaft (15), but separately from it and supported in its own bearings by the gear case structure. The drive is then through the astern gears (22 & 23) in the forward section of the housing to the main astern pinion (24) which then drives the main gear (17) in the opposite or astern direction.

Identification of drive elements

1. Forward Main Pinion Bearing
2. Aft Main Pinion Bearing
3. Propeller Thrust Bearing
4. Aft Main Bearing
5. Forward Astern Main Pinion Bearing
6. Aft Astern Main Pinion Bearing
7. Forward Astern Gear Bearing
8. Aft Astern Gear Bearing
9. Dual Rotary Air Seal
10. Dual Passage Air Shaft
11. Clutch Air Hose(s)
12. Clutch Spacer
13. Ahead Clutch
14. Ahead Clutch Drum
15. Main Ahead Pinion Shaft
16. Main Ahead Pinion
17. Main Gear
18. Main Gear Shaft Flange
19. Astern Clutch
20. Astern Clutch Drum
21. Astern Drive Gear Shaft
22. Astern Drive Gear
23. Astern Driven Gear
24. Main Astern Pinion



FALK AIRFLEX CLUTCH

The Falk Airflex Clutch used on marine reverse reduction drives is designed for inflation at engine idle speed. The fastest acceptable inflation rate is dependent upon the ability of the engine to react to the system inertias during a crash stop or reversal. The slowest acceptable inflation rate is dependent upon the clutches ability to dissipate the heat generated prior to clutch lockup. The proper inflation rate for a given installation will be dictated by that systems characteristics but generally will be in the range of 6 to 12 seconds.

Clutches and reduction gears are proportioned to withstand normal maneuvering; however, to avoid unnecessary wear and strain on connected parts, it is recommended that shaft reversals be made at reduced speed and power.

Some reduction gears are equipped with the optional slip clutch, which allows operation of the propeller at speeds below engine idle. Continuous slip operation will shorten the life of clutch liners and drums so this feature should only be used when conditions dictate.

Depending upon alignment and frictional resistance of the propeller drive shaft assembly, higher torque than normal may be required on some vessels to start the shaft turning. In this case, it may be necessary to begin standard orificed clutch inflation to break the shaft loose; returning to slip operation to maintain propeller speed once it has started.

Changes in vessel speed when operating in slip speeds may require occasional adjustment of the control to hold a particular speed.

LUBRICATION

The gear case must be filled to the proper level with the type lubricant specified on the nameplate. The correct level is indicated on the bayonet type oil gauge rod (dipstick). For approximate amount of lubricant, see nameplate.

The oil level must be checked before the unit is put into operation. Oil flowing in or out of the oil pan will affect dipstick level so re-check oil level if the quantity has been changed or if the unit was recently operated to be sure a stable reading is obtained. Add or drain oil as necessary.

Oil levels are Factory established with the unit sitting level. The slope of the propeller shaft varies depending on the vessel design so the operating oil level can only be determined after the unit is installed; at which time the oil gauge rod can be marked so the oil level can be checked while under way.

DO NOT mix different brands of lubricants. If the brand of lubricant in the unit is not available, drain and flush the unit before using the available brand.

See Page 4 for a listing of typical lubricants.

ROTARY AIR SEAL

Falk utilizes two types of rotary air seals; one with an oil cup and one without an oil cup. If the rotary air seal is equipped with an oil cup, add a few drops of light machine oil every four (4) to six (6) months. Rotary air seals without oil cups require no further lubrication.

AIR SHAFT BEARING

The aft air shaft bearing is either a fiber or an anti-friction bearing. The fiber bearing is lubricated from an oil cup located above the bearing. The oil cup must be kept full of an AGMA viscosity Grade 2 (ASTM S315/C68, ISO, VG68, approximate SAE20) petroleum base oil, Figure 1.

Units with a non-slip clutch are equipped with anti-friction bearings that are single shielded and grease lubricated. A standard grease fitting and vent hole are located in the bearing housing. At six (6) month intervals, remove the vent hole pipe plug and pump NLGI Grade 3 lithium base grease through the lube fitting until grease appears at the vent. Replace vent plug, Figure 2.

On units equipped with a slip clutch the air shaft bearing and internal bronze bushing are lubricated from an oil line supplying oil to the air shaft bearing cage cavity inboard of the bearing. The air shaft bearing is flood lubricated and oil flows to the internal bushing and returns to the oil sump through internal passages, Figure 3.

Some MR Models are furnished with a universal joint supporting the clutch end of the air shaft, Figure 5. The universal joint has a standard grease fitting and must be greased at 1000 hour intervals with a NLGI Grade 3 lithium base grease. Wipe off any excess grease before operating the clutch.

CLUTCH PILOT BEARING

Some MR Models require a grease lubricated pilot bearing mounted in the clutch spacer. A standard grease fitting mounted in the bearing cage is accessible through the clutch spacer. At approximately six month intervals, pump grease through the fitting until grease appears through the labyrinth seal, Figure 4. Wipe off any excess grease before operating the clutch. NOTE: Not all MR units are equipped with the clutch pilot bearing.

Use a NLGI Grade 3 lithium base grease. Grade 2 NLGI grease may be used in an emergency ONLY, but must be replaced with Grade 3 as soon as possible.

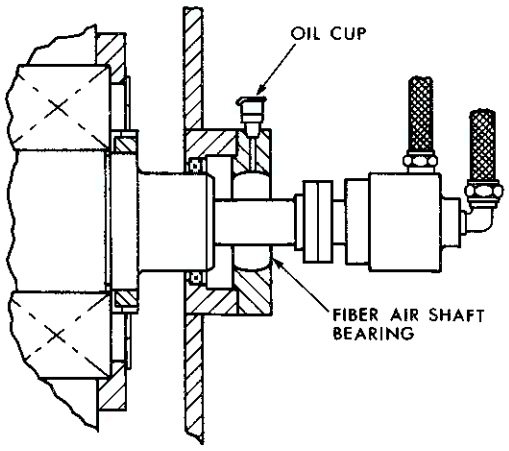


Figure 1

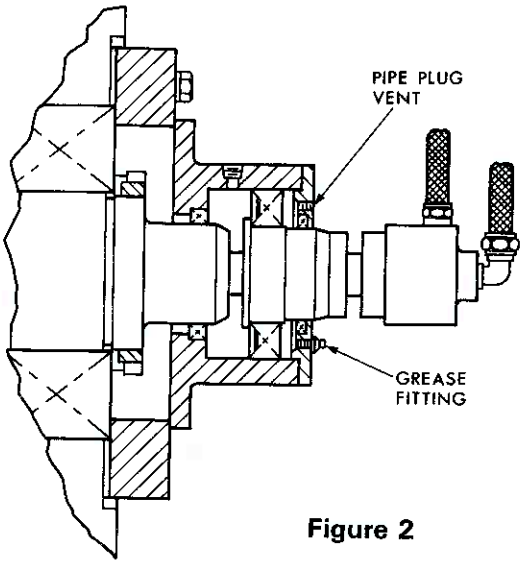


Figure 2

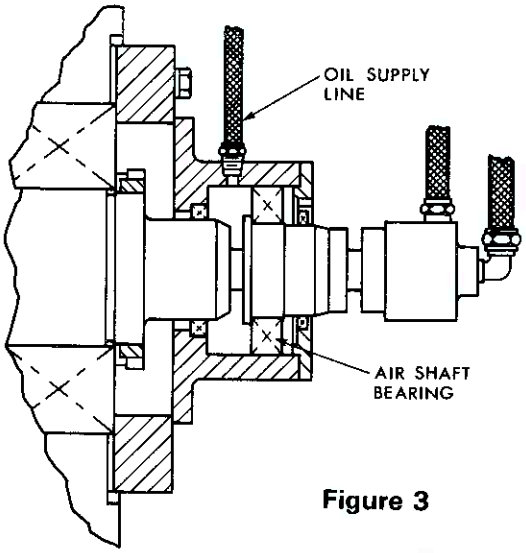


Figure 3

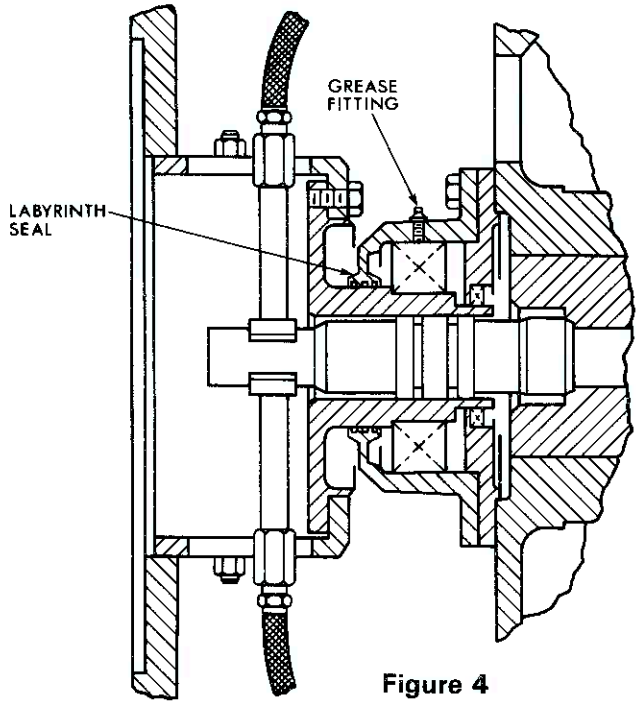


Figure 4

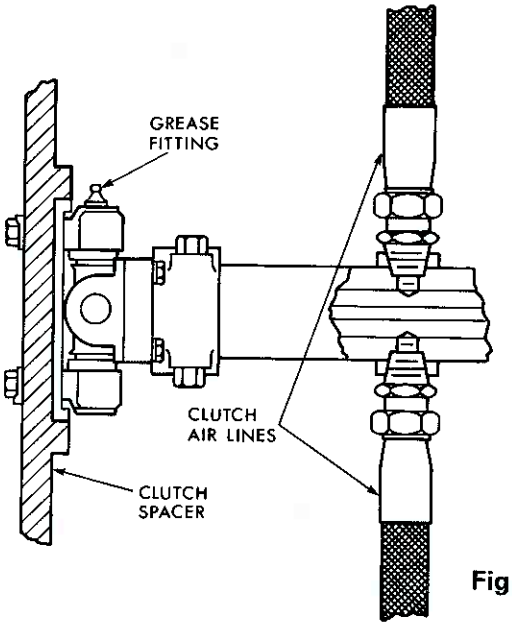


Figure 5

STANDARD OPERATING CONDITIONS

Clutch Air Supply

Maintain clutch pressure at 140-145 psig or as specified. It is recommended that pressure of the supply air to the clutches be monitored with an alarm system to be set for 130 psig falling pressure.

Falk recommends that the clutch air supply system include a pressure tank with at least 2.5 cubic foot capacity for each clutch assembly plus a pressure regulator, filter, safety valve and check valve upstream of the air tank and a valve downstream from the air tank. The filter and air tank should be suitably valved for draining.

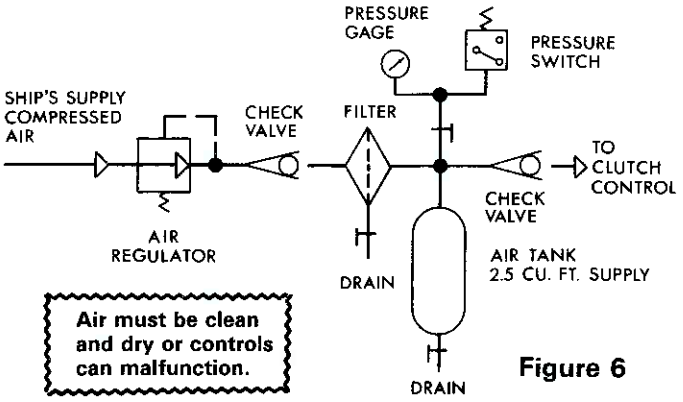
The air tank provides a stable air supply and emergency inflation of the clutch upon loss of ships supply air and the valving provides for limited service during operation without declutching (blow down of tank for example). A positive means to prevent accidental closing of a hand operated valve should be provided. All connections should be made on top of the tank except the drain line, Figure 6, Page 4.

CAUTION

Use of air from the clutch supply system for other components such as horns, may cause pressure drops which could result in clutch failure, especially if the recommended air tank is not supplied.

Lubricating Oil – Set water controls to maintain an oil supply temperature as read on the thermometer at the gear unit oil inlet manifold in the range of 100-125°F (38-52°C) for raw water cooling systems. Only minimal adjustment should be required, since the lubrication system is equipped with a 110°F (43°C) thermostatic bypass valve for the cooler. For skin cooling or closed circuit systems utilizing water temperatures up to 120°F (49°C) oil temperatures will be 10-20°F (6-11°C) hotter. A flow meter in either system is mounted in the lubrication piping to visually show oil flow and has electrical contacts to be wired by the shipyard to a warning device to indicate loss of flow. The oil cooler provided was selected for 40GPM water flow. Oil pressure based alarms are not recommended because the pressure changes with speed changes.

A high temperature oil switch for an alarm can be supplied when requested.



Air must be clean and dry or controls can malfunction.

Figure 6

EMERGENCY OPERATION

Loss of Air Supply – Provision is made for manual air supply to the clutch. There are two plugs on the outer flange of the clutch spacer, one in the ahead and one in the astern clutch air lines. With the engine shut down and the shaft locked to prevent rotation (windmilling from current, etc.) locate the plug leading to the ahead air supply and proceed as follows:

CAUTION

Be sure the engine can not be started from a remote location prior to the completion of this procedure.

Remove the ¾" pipe plug, part number 914017, as shown in Figure 7, and insert a ½" pipe plug, part number 914016 to block off air from the normal air supply hose. Put the ¾" pipe plug securely back in place and inflate the clutch through the Schrader valve (similar to an automobile tire valve) with a suitable air pump.

Whenever using emergency inflation, pressure must be maintained since there is no supply reservoir. If the clutch should start to slip (smoke) shut down immediately and restore air pressure. If rated pressure cannot be supplied, reduce speed and power to a level where the clutch will not slip during operation.

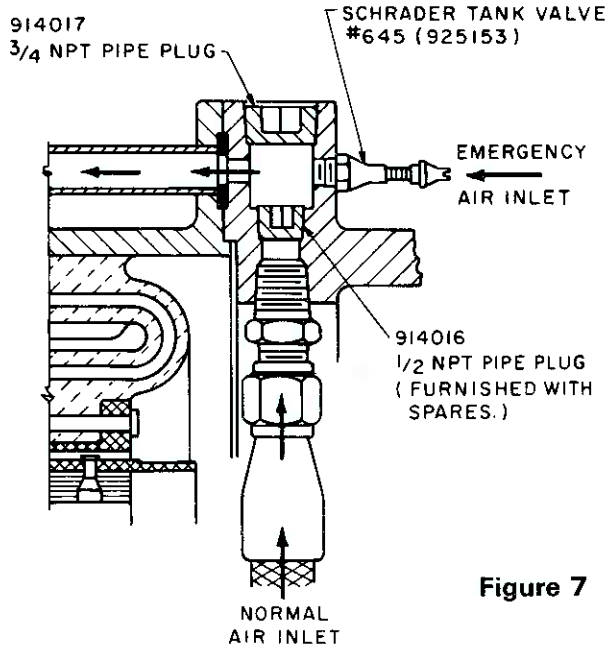


Figure 7

CAUTION

Clutch must be manually exhausted through the Schrader valve when emergency inflated. It will not exhaust on command from the control station.

Loss of Oil Pump – In the event of an oil pump failure, operate with extreme caution at reduced speed (idle), and only if there is no interference or rubbing of parts that will cause heat or sparks. The splash lubrication system built into the drive will provide adequate lubrication at reduced speed ONLY. NOTE: The lube oil cooler will also be inoperative. Repair or replace oil pump as soon as possible.

PRECAUTIONS

Do not open inspection covers when unit is in operation.

Do not allow any foreign matter to enter the unit through the inspection openings.

Loose objects should be kept away when inspection covers are open so they cannot be accidentally knocked or dropped into the drive.

Do not mix different brands of lubricants.

Do not inflate clutch without drum in it.

Do not allow equipment or materials (frayed electric wires, torches, etc.), which could cause ignition of the oil or oil vapor near the gear box openings.

Whenever clutch is overheated, inspect clutch drum for cracks.

Typical Lubricants for Gear Case – (See nameplate for type selection) Falk prefers that a mineral oil with rust and oxidation inhibitors (R & O) be used. The preferred viscosity range is 1335-1632 SSU at 100°F (38°C). Alternately a sulfur phosphorus type of EP compound of equivalent viscosity rating may be used.

The following table of typical lubricants is not intended to exclude lubricants not listed.

Lubricant Type		R & O Gear Oils	EP Oils
AGMA Viscosity Grade		6	6
ASTM Viscosity Grade		S1500/C320	S1500/C320
ISO Viscosity Grade		ISO-VG320	ISO-VG320
SAE Viscosity Grade Approx.		50 or 90	50 or 90
Viscosity at 104°F (40°C)	SSU	1335-1632	1335-1632
	cSt	288-352	288-352
Manufacturer		Lubricant	Lubricant
Amoco Oil Co.		Ind Oil #320	Permagear EP 110
Ashland Oil Inc.		ETC (R&O) #150	....
Atlantic Richfield Co.		Duro 320	Pennant NL 320
Chevron U.S.A. Inc		AW Machine Oil 320	NL Gear Compound 320
Cities Service Co.		Citgo Pacemaker 320	Citgo EP Compound 320
Conoco Inc.		Dectol R&O Oil 320	Gear Oil 320
Exxon Company, U.S.A.		Teresstic 320	Spartan EP 320
Gulf Oil Corp.		Harmony 320	EP Lubricant HD 320
Gulf Canada Limited		Harmony 111	SP Lubricant 100
E.F. Houghton & Co.		....	MP Gear Oil 120
Imperial Oil Ltd.		Teresso 320	Spartan EP 320
Keystone Div. Pennwalt Corp.		....	WG-1
Mobil Oil Corp.		DTE Oil AA	Mobilgear 632
Phillips Petroleum Co.		Magnus Oil 320	....
Shell Oil Co.		Turbo Oil 320	Omala Oil 320
Shell Canada Limited		Covil Oil 320	Omala Oil 320
Standard Oil Co. (Ohio)		....	Gearep 125
Sun Oil Co.		Sun R&O 1500	Sunep 1090
Texaco Inc.		Regal Oil R&O 320	Meropa 320
Texaco Canada Inc.		Regal R&O 320	Meropa 320
Union Oil Co. of Calif.		Unax AW 320	Extra Duty N6 Gear Lube 6EP