SERVICE MANUAL

FOR HYSTER POWER CONTROLLED WINCH

W5A OIL BRAKE SCH

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TABLE OF CONTENTS

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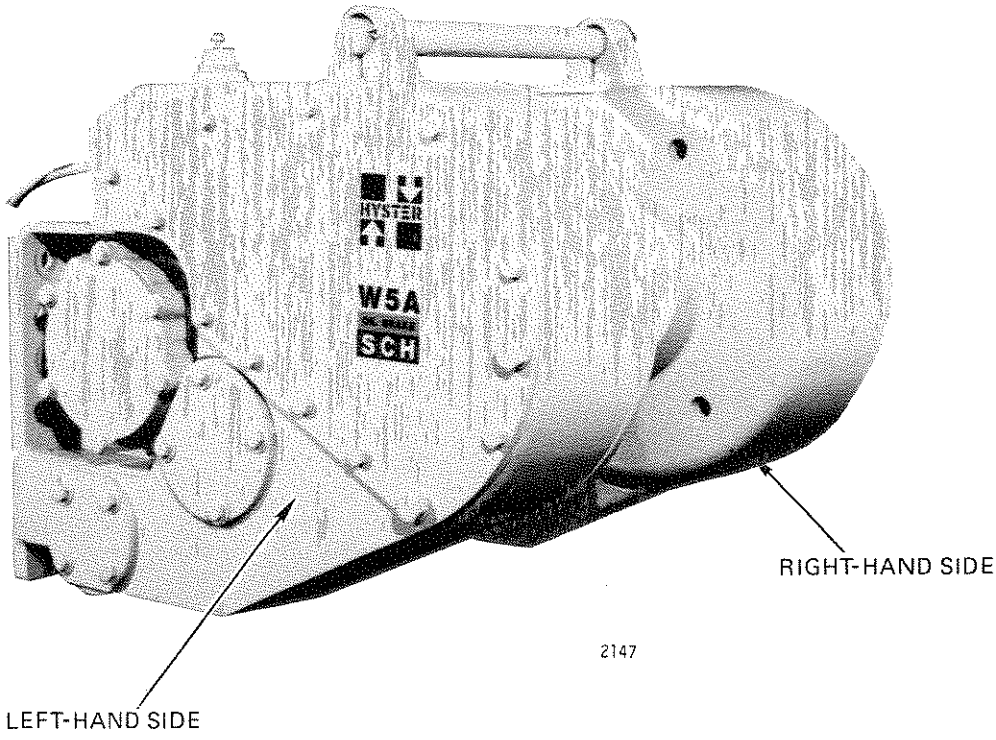
TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

INTRODUCTION

This Service Manual contains operation, maintenance and repair instructions for the W5A Power Controlled Towing Winch. Instructions are also included for removal and installation of the winch. Specification tables are provided which contain winch design data. Complete physical and functional descriptions of the winch are given to aid the serviceman in understanding the operation of the winch subassemblies.



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SPECIFICATIONS AND DESCRIPTIONS

1-1. GENERAL.

1-2. This section contains physical and functional descriptions of the W5A Towing Winch.

TABLE 1-1. DRUM LINE CAPACITIES

ITEM	8.50 INCH (216 mm) DIAMETER DRUM		7.75 INCH (197 mm) DIAMETER DRUM	
	FEET	METERS	FEET	METERS
Cable Capacity (Allow for loose or unevenly spooled cable.)				
5/8-inch (16 mm) cable	402 Ft.	(123 m)	422 Ft.	(128 m)
3/4-inch (19 mm) cable	279 Ft.	(85 m)	293 Ft.	(89 m)
7/8-inch (22 mm) cable	205 Ft.	(63 m)	216 Ft.	(66 m)

TABLE 1-2. HYDRAULIC SPECIFICATIONS (Sheet 1 of 2)

ITEM	DESIGN DATA	REFERENCE FIGURE
CONTROL VALVE		4-3
High Pressure Relief	220 ± 5 PSI (15.5 ± 0.35 kg/cm²)	
Cooling Oil Pressure	4-10 PSI (0.028-0.70 kg/cm²)	
Reverse Modulator Valve (pressure differential between brake and clutch)	80 ± 5 PSI (5.63 ± 0.35 kg/cm²)	
Forward Modulator Valve (pressure differential between brake and clutch)	80 ± 5 PSI (5.63 ± 0.35 kg/cm²)	
HYDRAULIC PUMP		4-3
Pump Output at Engine RPM: At 1500 RPM (or approximately half engine speed)	12 GPM (45.4 lts/min.)	
SUCTION FILTER		4-1
Type	50 Mesh, Full-Flow Strainer	

TABLE 1-2. HYDRAULIC SPECIFICATIONS (Sheet 2 of 2)

ITEM	DESIGN DATA	REFERENCE FIGURE
PRESSURE FILTER		4-1
Type	20 Micron, Full-Flow, Replaceable Element	
Relief Valve Opening Pressure	25 ± 5 PSI (1.76 ± 0.35 kg/cm²)	
OIL		4-1
Capacity	11.5 Gals. (45 lts.)	
Type	Dexron II or C3	

TABLE 1-3. TORQUE SPECIFICATIONS

ITEM	DESIGN DATA		REFERENCE FIGURE
	Foot-Pounds	kg-m	
Bevel Gear and Brake Shaft Assembly (Common Shaft):			
Retainer Capscrews	75	10	5-15, Steps 6&11
Brake Assembly:			
Oil Brake Assembly Capscrews	130	18	5-17, Step 9
Oil Brake Cover Capscrews	75	10	5-17, Step 9
Clutch Piston Housing Capscrews	30	4	5-14, Step 9
Control Valve Mounting Capscrews	48	7	5-10
Intermediate Shaft Assembly:			
Retainer Capscrews	75	10	5-14, Step 9
Drum Shaft Assembly Capscrews	75	10	5-14, Step 9
Drum to Drum Adapter Capscrews	150	20	5-14, Step 4
Drum Adapter Bearing Retainer Capscrews	75	10	5-13, Step 3
PTO Shaft Carrier Capscrews	75	10	5-15, Step 11
Housing Covers, Miscellaneous	75	10	5-15, Step 10

NOTE Table 1-4 provides information on improvements available for older models. Copies of the material listed are available from your dealer.

TABLE 1-4. REFERENCE MATERIALS

ORDER NUMBER	DESCRIPTION/TITLE	PAGE
599680	Parts Manual - W5A	
AO-A-10R1	Parts-Service Gram/Hydraulic System Improvements	1-18
AO-A-12	Parts-Service Gram/Square Cornered Cam	5-20
AO-D-10R1	Parts-Service Gram/Relocation of Suction Tube Pick-up	
AO-D-15	Parts-Service Gram/Charge Off the Inlet	1-18
AO-Z-23	Parts Service Gram/Increased Oil Capacity	1-2
A1-B- 9R1	Parts-Service Gram/PTO and Coupling Change-Fiat-Allis	5-5
A3-A-14R1	Parts-Service Gram/Oil Brake Improvements	1-10
A3-A-16	Parts-Service Gram/Paper Type Friction Material	5-13
A3-A-17	Parts-Service Gram/Sealer for Brake Pack Shims	5-38
A3-C- 6R2	Parts-Service Gram/Bronze Bushed Handlevers	1-15
A3-D- 8R1	Parts-Service Gram/Freespool Spring Tension	5-30
A99-Z-17R1	Parts-Service Gram/Cable Ferrules	1-1
A99-Z-19R2	Parts-Service Gram/Line Pulls, Cable Size, Cable Capacity	1-1

1-3. SERIAL NUMBER DATA. (See Figure 1-1.)

1-4. Units manufactured prior to Serial Number 1976 have the following numbering system. The nameplate is located on the top, left-hand side of the winch frame and contains the serial number, model number and special application data. The serial number and model number are also stamped on the winch frame near the nameplate. The serial number indicates the design series, manufacturing plant, serial number and year manufactured. A typical serial number designates the following:

Example:	A121	P	1975	S
	(1)	(2)	(3)	(4)

(1) The first letter and number denote the design series and model of the unit.

(2) The second letter (P) denotes the unit was manufactured at Portland.

(3) The number series designates the serial number.

(4) The final letter designates the year of unit manufacture, starting with the letter "S" indicating 1972.

1-5. Beginning with Serial Number 1976, winches have the following identification system. The nameplate is located on the left-hand side of the winch frame and contains the Serial Number, Model Number and special application data. The serial number is also stamped on the winch frame on the top right hand side. A typical serial number designates the following:

Example: W5A P 4 B 1995 F31
(1) (2) (3) (4) (5) (6)

(1) Winch Model Designation

(2) Type of Winch Drive: P - Power Controlled

(3) Gear Ratio: 1 - 24.4 to 1
2 - 25.2 to 1
3 - 28.4 to 1
4 - 32.3 to 1
5 - 39.9 to 1
6 - 12.2 to 1
7 - 58.2 to 1
8 - 41.5 to 1

(4) Internal Options: A - Power Forward Only (PFO)
B - Power Forward and Reverse (PFR)

(5) Sequence Number

(6) Tractor or Skidder Make And Model/Serial Number where applicable.

TABLE 1-5 – SERIAL NUMBER DATA

Tractor or Skidder Make	Code	Model	Serial Number	Gear Ratio	Pump Rotation	Forward Clutch Location
Fiat-Allis	A31	8 & FL-9		4	CW	RH
	A32	10B & FL-10B		4	CW	RH
Caterpillar	C31	D3 & 931		4	CCW	LH
	C32	D4 PS	83J3553 Up, 47H1786 Up 59J2553 Up, 7R926 Up 28X, 77W, 69X, 51X, 52X, 71X	2	CCW	LH
	C33	528		6	CCW	LH
Timberjack	D31	550		1	CCW	LH
FMC	F31	210 CA		2	CCW	LH
International	H31	175		4	CCW	LH
Komatsu	K31	D45A-1		5	CW	RH
Massey-Ferguson	M31	D400 C		4	CW	RH
J. I. Case	R31	1150-B		4	CCW	LH
	*R32	1150-B		4	CW	RH
Can-Car	T31	C8B		3	CCW	LH

CW – Clockwise rotation.
CCW – Counter-clockwise rotation.
NOTE: Rotation determined by looking in the forward direction of the tractor.
* High mounting effective with S/N sequence No. 2069.

1-6. PHYSICAL DESCRIPTION.

1-7. Towing Winch. (See Figure 1-1.)

1-8. The W5A Towing Winch is designed as a Power-Forward/Reverse (PFR) or Power-Forward Only (PFO) unit for use on vehicles with a constant running power take-off (PTO). The winch employs a hydraulically-actuated oil clutch(es) to shift the winch gear train to Forward, Neutral, or Reverse (PFR) or Forward and Neutral (PFO). A spring-applied, hydraulically-released oil brake provides braking. A free-spooling arrangement is standard.

1-9. The winch is a self-contained unit in that all major components are mounted inside a one-piece steel frame. The gear train consists primarily of: (1) a PTO shaft assembly, (2) a bevel gear and brake shaft assembly (common shaft), (3) an intermediate shaft assembly and (4) a drum shaft assembly. The shaft assemblies are mounted in the center and left-hand section. These components are accessible by removing the top and left-hand side access covers. The control valve, hydraulic pump, pressure filter, accumulators and associated hydraulic lines are located in the right-hand section. These components are accessible by removing the top and right-hand side access covers. The suction filter is located in the lower left-hand side below the oil brake assembly. The control valve and related hydraulic lines serve as the control mechanism.

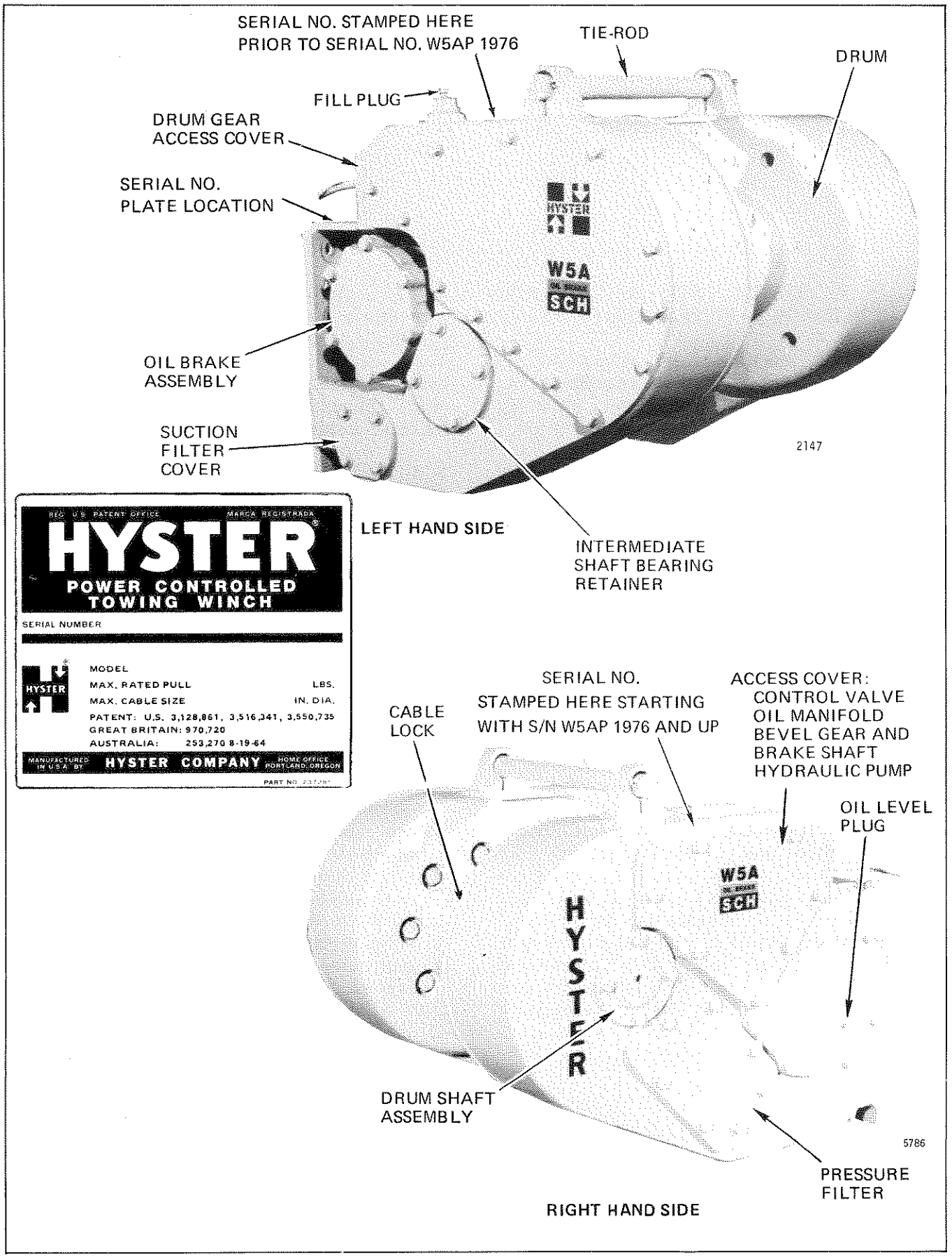


FIGURE 1-1. W5A TOWING WINCH

1-10. GEAR TRAIN, POWER-FORWARD/ REVERSE WINCH (PFR). (See Figure 1-2.)

1-11. The PFR gear train consists primarily of: (1) a PTO shaft assembly, (2) bevel gear and brake shaft assembly (common shaft), (3) an intermediate shaft assembly, and (4) a drum shaft assembly.

1-12. The PTO shaft assembly consists primarily of: (1) a splined shaft, (2) bevel pinion gear and (3) a pump drive sprocket. The front end of the shaft is splined to mate with the tractor PTO. The rear end of the shaft carries the pump drive sprocket and bevel pinion gear. A carrier supports the PTO shaft with a double-row ball bearing located just forward of the sprocket.

1-13. The bevel gear and brake shaft assembly consists primarily of: (1) a splined shaft, (2) an oil manifold, (3) two oil clutches with bevel gears, (4) a spacer, (5) four ball bearings (for bevel gear rotation), (6) two tapered roller bearings (one at each end of the shaft), (7) an intermediate pinion gear, and (8) an oil brake. The shaft is center-drilled and cross-drilled to carry pressurized oil to the clutch assemblies and the brake assembly. The hydraulic oil manifold, located on the right-hand end of the bevel gear and brake shaft, distributes pressurized oil to the clutches and brake. Three seal rings on the manifold end of the bevel gear shaft prevent internal leakage of the pressurized oil. The bevel gear shaft is supported by two tapered roller bearings. The clutch assemblies are splined to the bevel gear shaft. The bevel gears are bolted to the clutch carriers which rotate independently of the bevel gear shaft on ball bearings. The oil brake assembly is splined to the left-hand end of the bevel gear shaft. The intermediate pinion gear is splined to the bevel gear shaft next to the oil brake assembly.

1-14. The intermediate shaft assembly includes: (1) a drum pinion gear, (2) two tapered roller bearings, (3) an intermediate gear and (4) a dental clutch (free-spool arrangement). The drum pinion gear is an integral part of the intermediate shaft. The shaft rotates on two tapered roller bearings. The intermediate gear rotates freely on the drum pinion gear (shaft end). A dental clutch (dog clutch) is used to lock the intermediate gear to the drum pinion gear.

1-15. The drum gear is shimmed and bolted to a drum adapter which is supported by two tapered roller bearings. The left-hand side of the drum is bolted to the drum adapter. The right-hand side of the drum is supported on the drum shaft by a single roller bearing. The drum shaft is bolted to the winch housing and does not rotate. This allows the drum gear, drum adapter and drum to rotate around the drum shaft. In free-spooling, the dental clutch (dog clutch) is disengaged from the drum pinion gear. This unlocks the drum gear from the gear train, allowing the drum to rotate freely. During this condition, line can be pulled off the drum by hand.

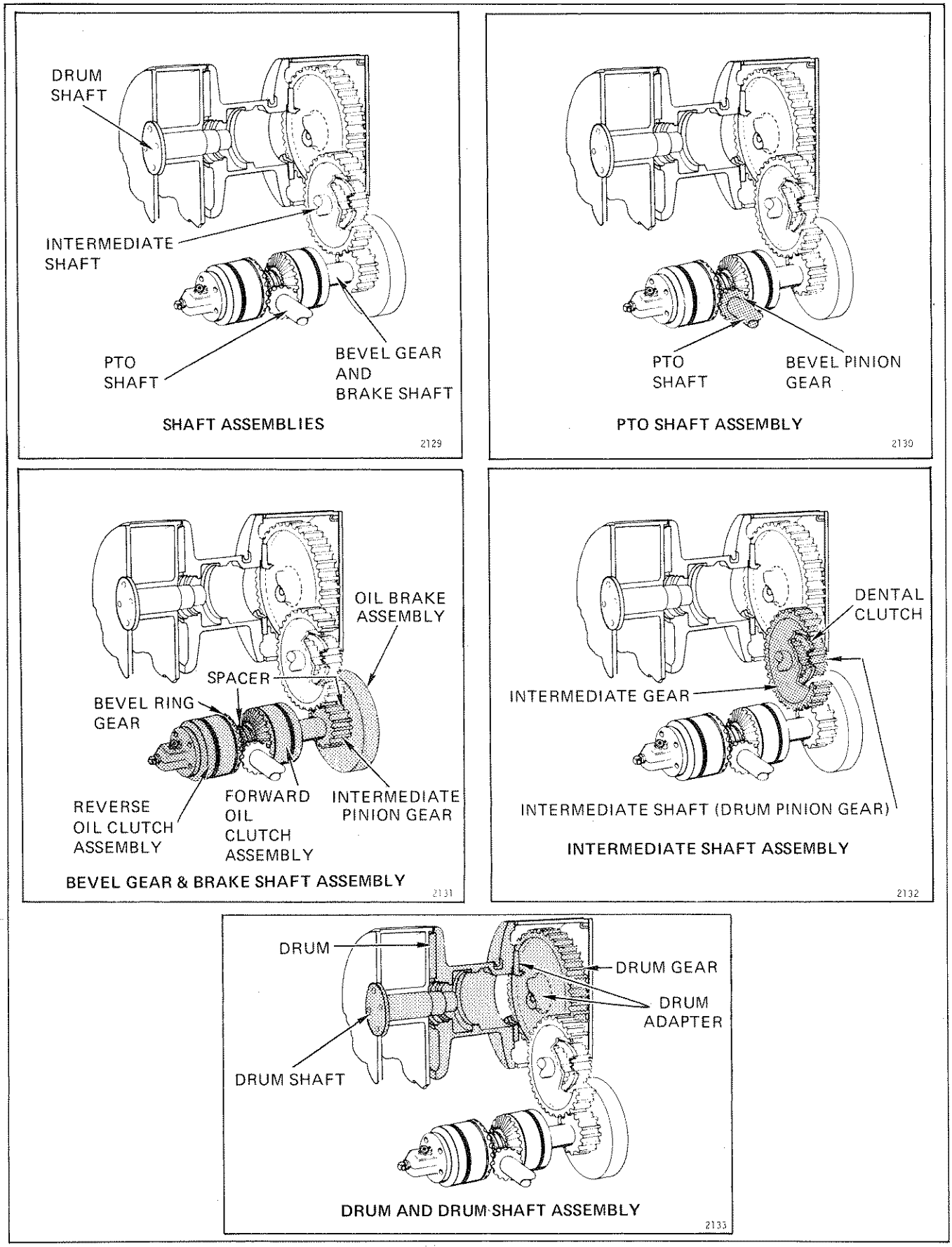


FIGURE 1-2. GEAR TRAIN, POWER-FORWARD/REVERSE WINCH (PFR)

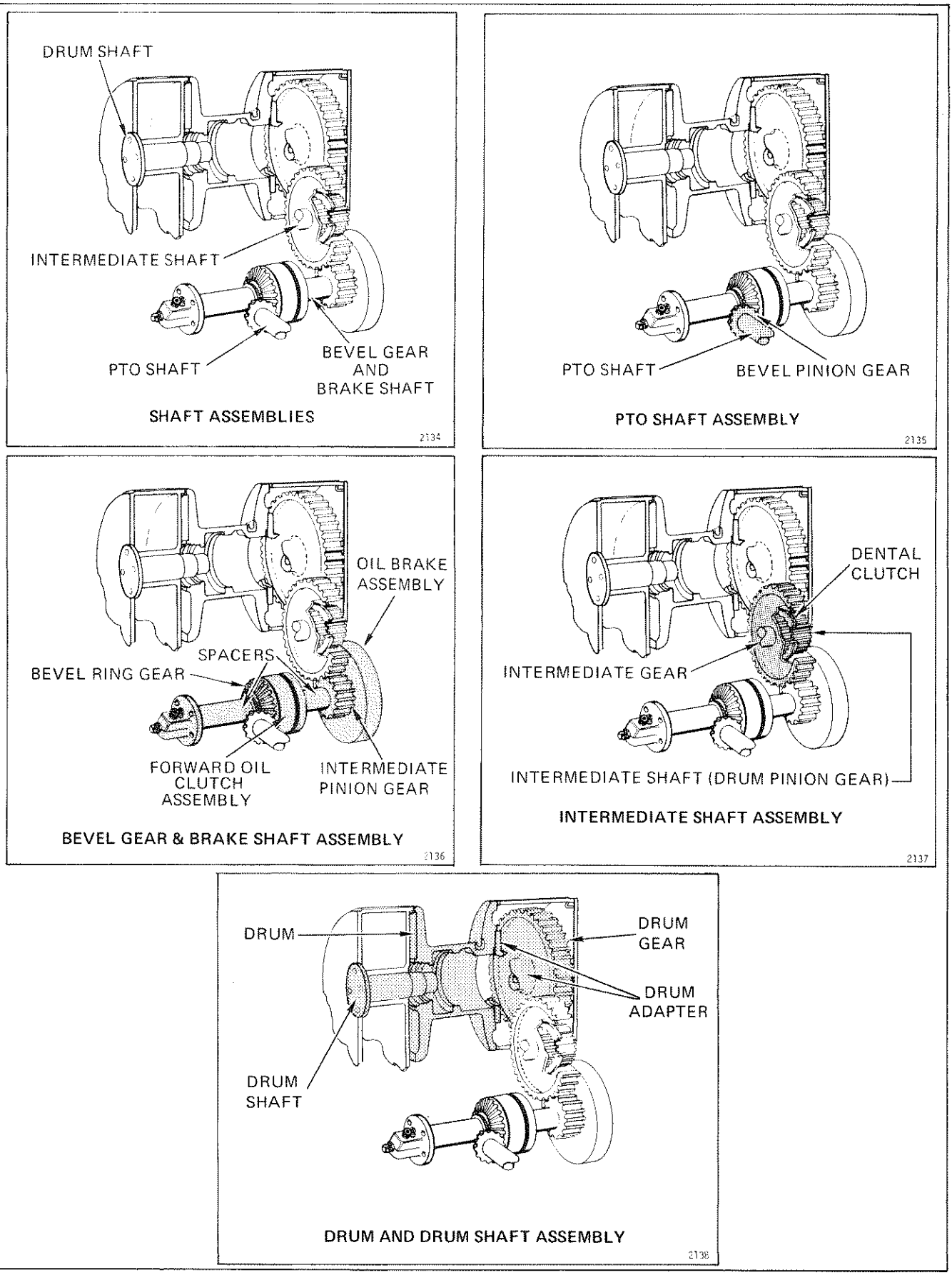


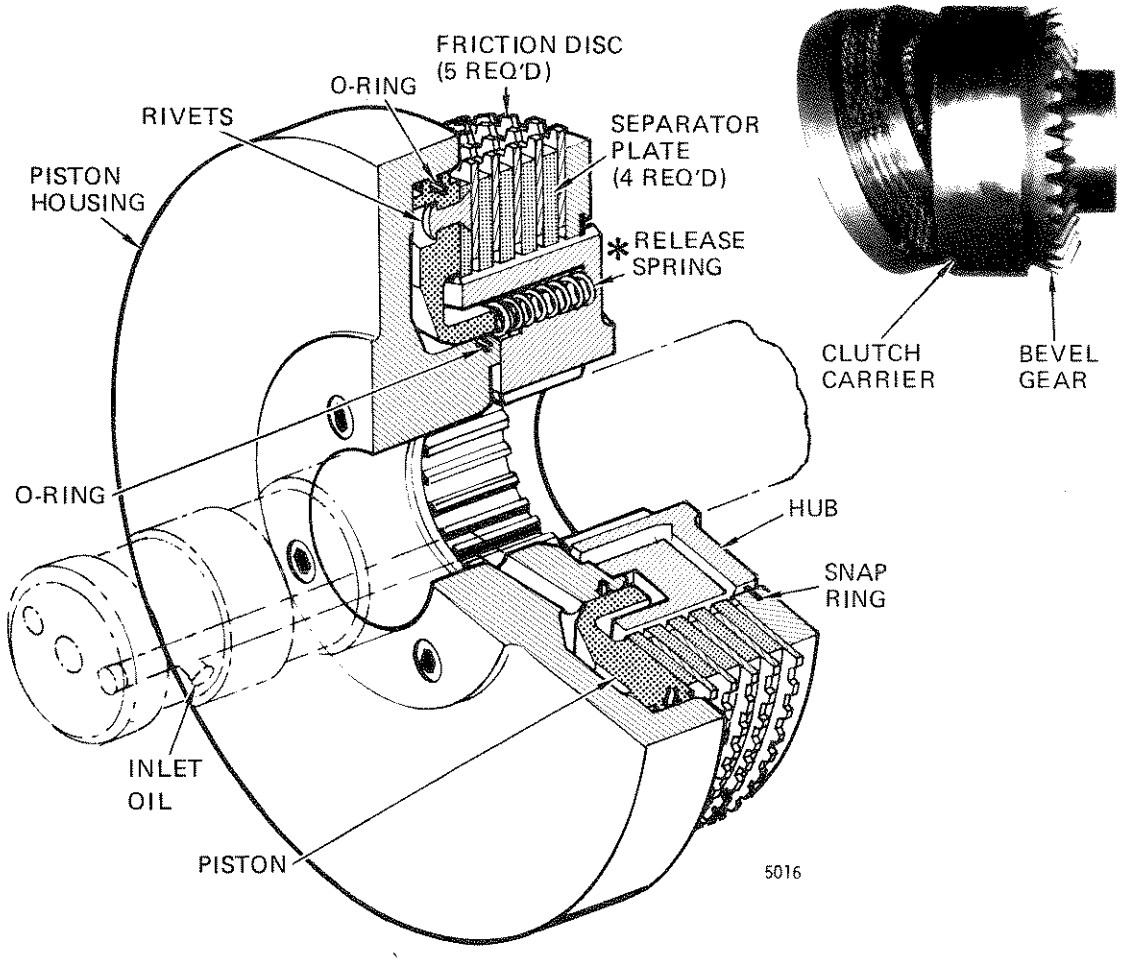
FIGURE 1-3. GEAR TRAIN, POWER-FORWARD ONLY WINCH (PFO)

1-16. GEAR TRAIN, POWER-FORWARD ONLY WINCH (PFO). (See Figure 1-3.)

1-17. The PFO gear train consists primarily of: (1) a PTO shaft assembly, (2) bevel gear and brake shaft assembly (common shaft), (3) an intermediate shaft assembly and (4) a drum shaft assembly.

1-18. The PTO shaft assembly consists primarily of: (1) a splined shaft, (2) a bevel pinion gear, and (3) a pump drive sprocket. The front end of the shaft is splined to mate with the tractor PTO. The rear end of the shaft carries the pump drive sprocket and bevel pinion gear. A carrier supports the PTO shaft with a double-row ball bearing located just forward of the sprocket.

1-19. The bevel gear and brake shaft assembly consists primarily of: (1) a splined shaft, (2) an oil manifold, (3) an oil clutch with bevel gear, (4) a spacer, (5) two ball bearings (for bevel gear rotation), (6) two tapered roller bearings (one at each end of the shaft), (7) an intermediate pinion gear and (8) an oil brake. The shaft is center-drilled and cross-drilled to carry pressurized oil to the clutch and brake assemblies. The hydraulic oil manifold, located at the right-hand end of the bevel gear shaft, distributes pressurized oil to the clutch and brake assemblies. Three seal rings on the manifold end of the bevel gear shaft prevent internal leakage of the pressurized oil. The bevel gear shaft is supported by two tapered roller bearings. The clutch assembly is splined to the bevel gear



*The number of springs will vary according to winch serial number.
8 springs are used up to S/N W5AP2482.
14 springs are used starting at S/N W5AP2482.

FIGURE 1-4. OIL CLUTCH ASSEMBLY

shaft. The bevel gear is bolted to the clutch carrier which rotates independently of the bevel gear shaft on ball bearings. The oil brake assembly is splined to the left-hand end of the bevel gear shaft. The intermediate pinion gear is splined to the bevel gear shaft next to the oil brake assembly.

1-20. The intermediate shaft assembly includes: (1) a drum pinion gear, (2) two tapered roller bearings, (3) an intermediate gear and (4) a dental clutch (free-spool arrangement). The drum pinion gear is an integral part of the intermediate shaft. The shaft rotates on two tapered roller bearings. The intermediate gear rotates freely on the drum pinion gear (shaft end). A dental clutch is used to lock the intermediate gear to the drum pinion gear.

1-21. The drum gear is shimmed and bolted to a drum adapter which is supported by two tapered roller bearings. The left-hand side of the drum is bolted to the drum adapter. The right-hand side of the drum is supported on the drum shaft by a single roller bearing. The drum shaft is bolted to the winch housing and does not rotate. This allows the drum gear, drum adapter and drum to rotate around the drum shaft. In free-spooling, the dental clutch (dog clutch) is disengaged from the drum pinion gear. This unlocks the drum gear from the gear train, allowing the drum to rotate freely. During this condition, line can be pulled off the drum by hand.

1-22. OIL CLUTCH ASSEMBLY. (See Figure 1-4.)

1-23. The oil clutch assembly consists primarily of: (1) a piston housing, (2) clutch piston, (3) five friction discs, (4) four separator plates, (5) a clutch hub, (6) eight release springs, (7) one thrust ring and (8) one snap ring. The clutch piston is installed inside the piston housing and is sealed by two O-rings. The clutch hub is mounted to the piston housing by six socket head capscrews. The clutch hub is internally splined to mate with the bevel gear shaft and externally splined to mate with the thrust ring and four separator plates. Eight release

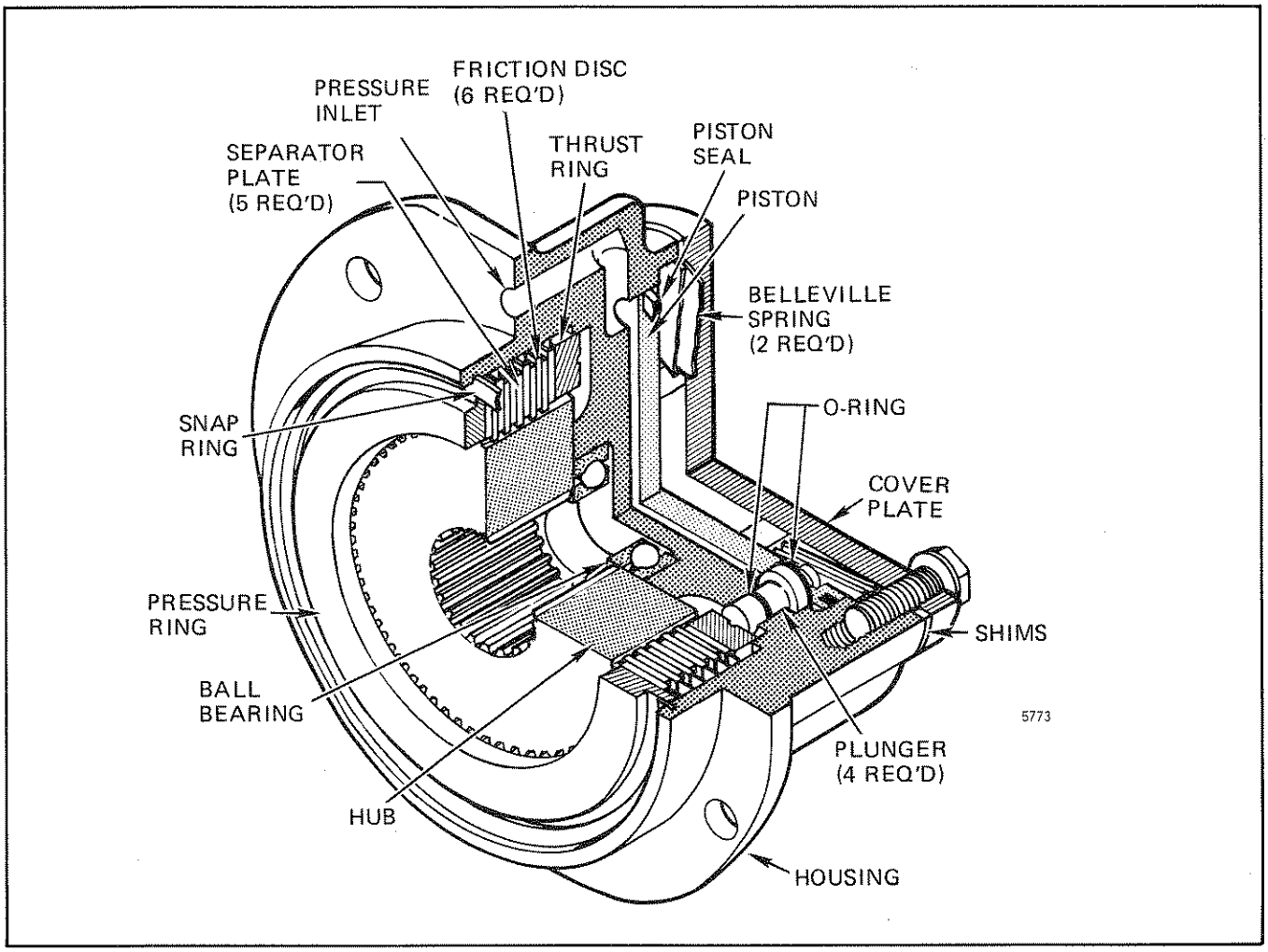


FIGURE 1-5. OIL BRAKE ASSEMBLY

springs installed in the bores in the clutch hub maintain the piston in the normal (relaxed) position. The four separator plates and five friction discs are alternately mounted over the external splines of the clutch hub. A fifth separator plate is riveted to the piston. The separator plates have internal teeth that mate with the external splines of the hub. The friction discs have external teeth to mate with the internal splines of the clutch carrier. During clutch operation, pressurized oil flows into the cavity between the clutch piston and the piston housing. This oil moves the piston away from the piston housing and forces the separator plates against the friction discs. The friction discs rotate continuously with the clutch carrier and bevel gear. Compressing the separator plates and friction discs cause the hub and bevel gear shaft to rotate (carrier and hub locked up). When oil pressure is removed, the eight release springs force the piston against the piston housing. This allows the friction discs to move, releasing the separator plates. At this time, the carrier and hub are not locked up and the bevel gear shaft will no longer rotate. When the clutch is released (separator plates and friction discs separated), cooling oil flows through the oil manifold to lubricate and cool the discs.

1-24. OIL BRAKE ASSEMBLY. (See Figure 1-5.)

1-25. The oil brake assembly consists primarily of: (1) a brake housing, (2) cover, (3) two belleville springs, (4) a thrust ring, (5) piston, (6) hub, (7) ball bearing, (8) pressure ring, (9) six friction discs, (10) five separator plates and (11) four plungers. The brake housing is bolted to the winch housing by six capscrews. The cover is held to the brake housing by six capscrews and serves as a backing plate for the two belleville springs. The piston operates within the brake housing between the four plungers and two belleville springs. A single seal is located in the circumference of the piston. The four plungers, located near the middle of the housing, transmit movement of the piston to the thrust ring. The thrust ring transmits and distributes the actuating forces to the separator plates and friction discs. The five separator plates have internal teeth to mate with the external splines of the hub. The external splines of the six friction discs mate with the internal splines of the stationary brake housing and, therefore, will not rotate. The hub is internally splined to mate with the bevel gear shaft. It is retained within the brake housing by a pressure ring and snap ring. The ball bearing in the center of the brake housing supports the left-hand end of the bevel gear shaft. The oil brake assembly is a normally applied brake unit which requires hydraulic oil pressure to release the brake. In BRAKE-ON the belleville springs are partially compressed to force the friction discs and separator plates together. The brake will remain ON (locked up) until sufficient hydraulic pressure is applied to the piston (plunger side) to overcome the force of the belleville springs and release the brake.

1-26. CONTROL VALVE ASSEMBLY, POWER-FORWARD/REVERSE WINCH (PFR). (See Figure 1-6.)

1-27. The valve assembly controls the flow of hydraulic oil to and from the oil brake and clutches. The valve is an open-center valve consisting primarily of: (1) a valve body, (2) relief valve assembly, (3) a control spool assembly and (4) forward and reverse modulator valves. Passages within the valve body connect the spool bores with inlet, forward, reverse, brake and cooling oil (dump) ports either directly or through varying flow paths governed by the spool. Moving the spool connects these passages to obtain the desired hydraulic oil flow or pressure buildup.

1-28. The control spool assembly consists primarily of a spool (W-20 or W-21), detent balls, retainer, neutral return spring, snap ring, O-rings, and cap assembly. The valve body acts as a mechanical stop for the spool in the forward position. In the reverse position, spool travel is limited by spool contact with the detent balls. Further spool travel in the reverse direction will cause the detent balls to lock the spool in the brake off position. The neutral return spring ensures that the control spool returns to NEUTRAL when the control lever is released or moved out of detent.

1-29. The forward modulator valve is used during forward inching to regulate the clutch hydraulic pressure so that it is 80 PSI (5.63 kg/cm^2) less than the brake pressure. This pressure differential is referred to as the forward overlap. On early units, the forward modulator was non-adjustable, but later models have an adjustment to set this pressure overlap. When the control spool is in full forward the modulator valve is bypassed and both the brake and forward clutch pressures are equal.

1-30. The reverse modulator valve is used during reverse inching to regulate the clutch hydraulic pressure so that it is 80 PSI (5.63 kg/cm^2) less than the brake pressure. This pressure differential is referred to as the reverse overlap. An adjustment is provided so that the pressure overlap can be set. When the control spool is in full reverse, the modulator valve is bypassed, and both the brake and reverse clutch pressures are equal.

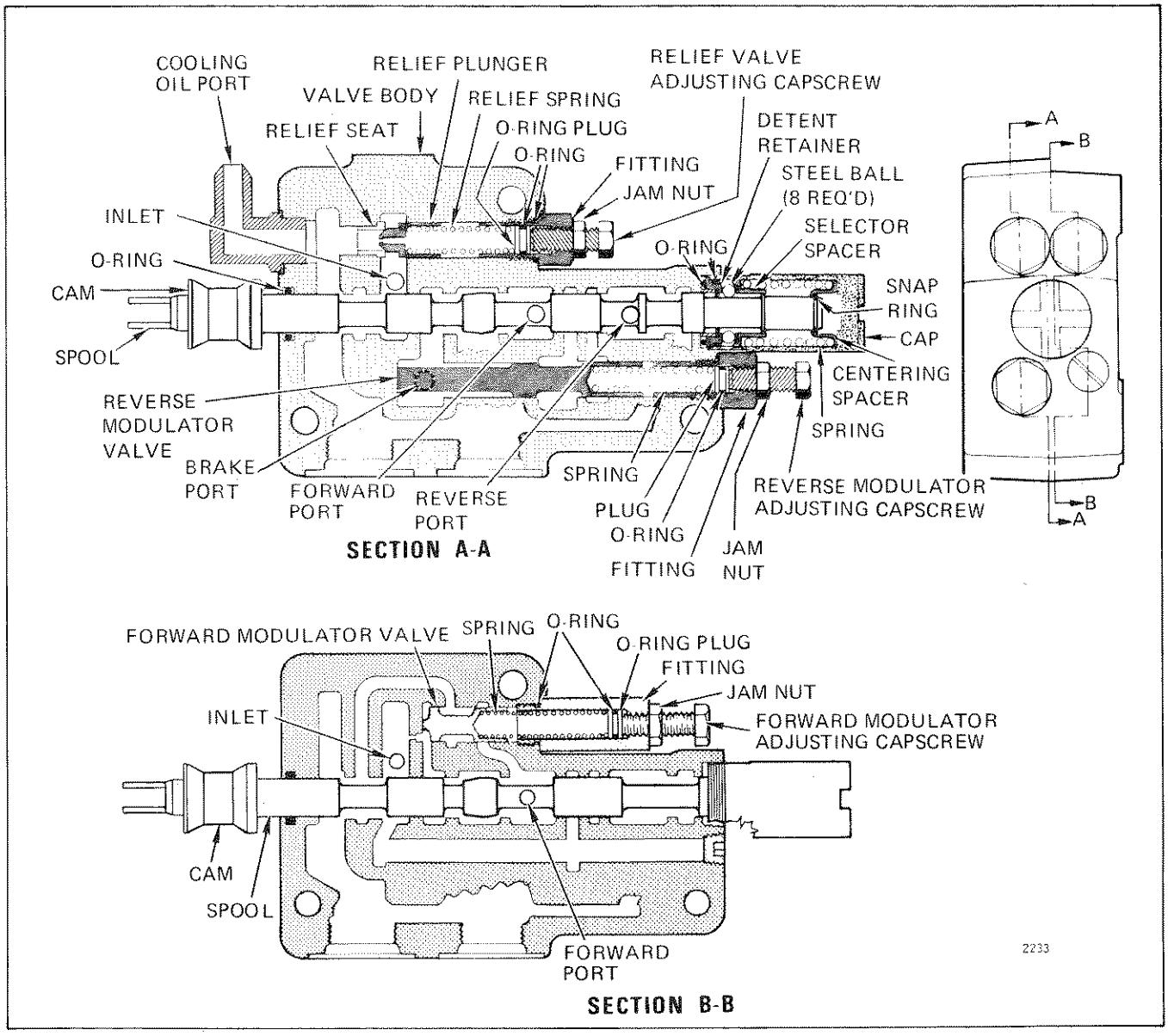


FIGURE 1-6. CONTROL VALVE ASSEMBLY POWER-FORWARD/REVERSE WINCH (PFR)

1-31. CONTROL VALVE ASSEMBLY, POWER-FORWARD ONLY (PFO). (See Figure 1-7.)

1-32. The control valve assembly controls the flow of hydraulic oil to and from the oil brake, forward clutch and free-spool actuator. The valve assembly is an open-center valve consisting primarily of: (1) a valve body, (2) relief valve assembly, (3) a control spool assembly, and (4) a forward modulator valve. Passages within the valve body connect the spool bores with inlet, forward, free-spool, brake, and cooling oil (dump) ports either directly or through varying flow paths governed by the spool. Moving the spool connects these passages to obtain the desired hydraulic oil flow or pressure buildup.

1-33. The control spool assembly consists primarily of a spool (W-31 or W-32), detent balls, retainer, neutral return spring, snap ring, O-rings and cap assembly. The valve body acts as a mechanical stop for the spool in the forward position. In the brake off position, spool travel is limited by spool contact with the detent balls. Further spool travel in the brake off direction will cause the detent balls to lock the spool in the free-spool position. The neutral return spring ensures that the control spool returns to NEUTRAL when the control lever is released or moved out of detent.

1-34. The forward modulator valve is used during inching to regulate the clutch hydraulic pressure so that it is 80 PSI (5.63 kg/cm²) less than the brake

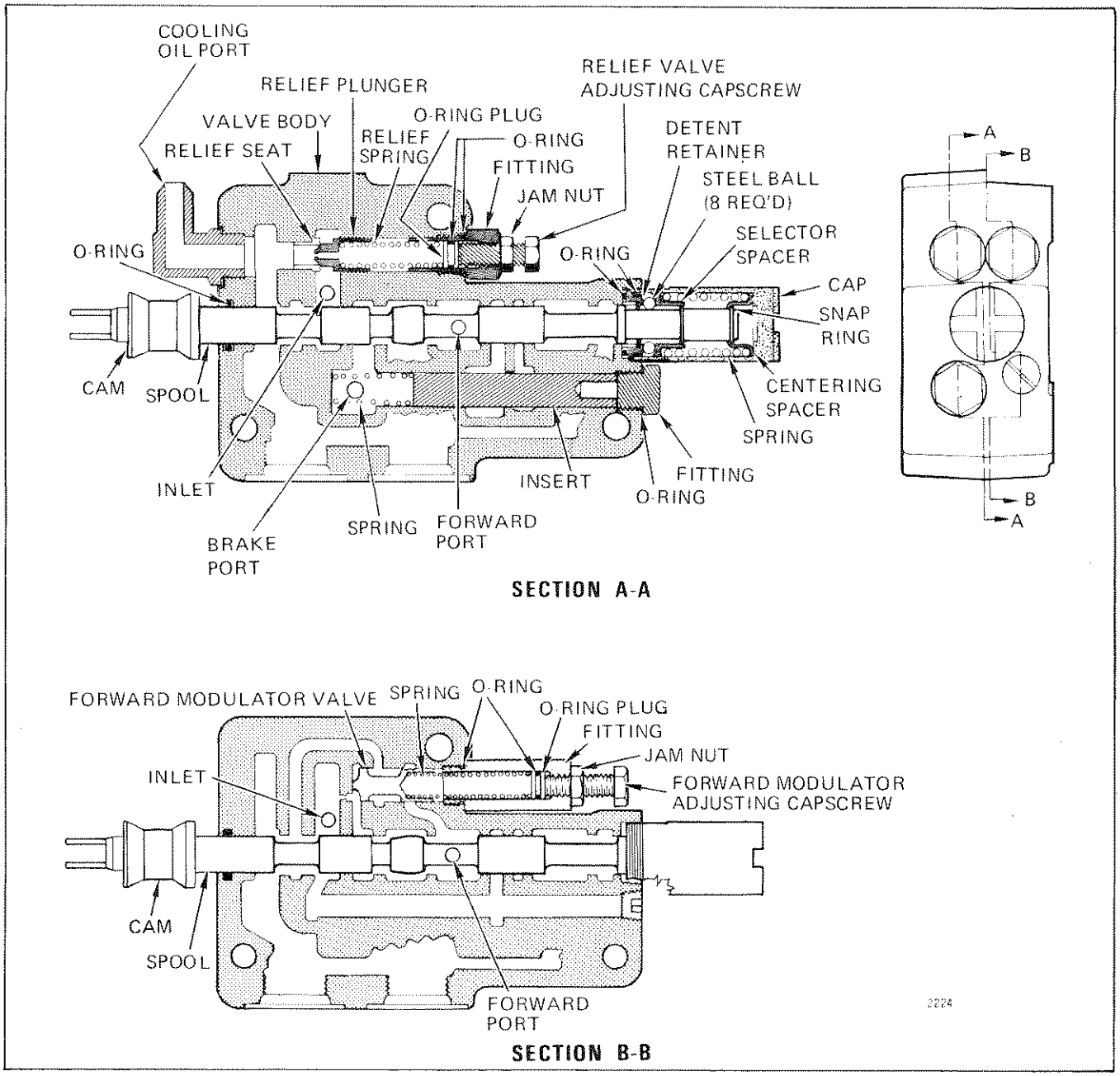


FIGURE 1-7. CONTROL VALVE ASSEMBLY FOR POWER-FORWARD ONLY WINCH (PFO)

pressure. This pressure differential is referred to as the forward overlap. On early units the forward modulator was non-adjustable, but later models have an adjustment to set this pressure overlap. When the control spool is in full forward, the modulator valve is bypassed, and both the brake and forward clutch pressures are equal.

1-35. ACCUMULATORS. (See Figure 1-8.)

1-36. The accumulators are a diaphragm type that have a nitrogen charge of 100 PSI (7.04 kg/cm^2). The two accumulators are teed together. High pressure oil is stored in the accumulators and is released by a cam actuated valve. This provides pressure for the system should the vehicle PTO stall.

1-37. HYDRAULIC PUMP ASSEMBLY.

1-38. The hydraulic pump is a positive-displacement, external gear pump that is chain driven by a sprocket on the PTO shaft assembly. The pump inlet port is connected to the winch suction filter. The outlet port is connected through the pressure filter to the control valve inlet port.

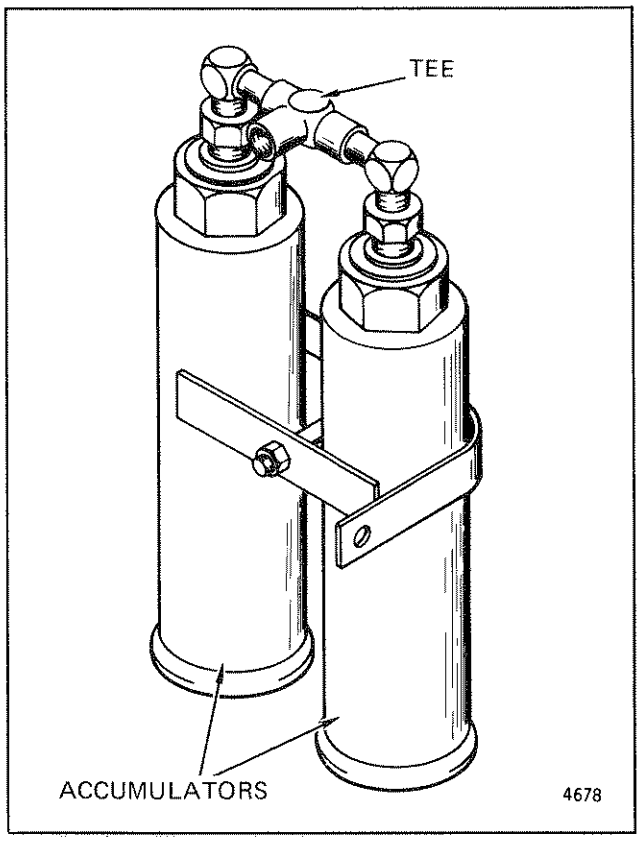


FIGURE 1-8. ACCUMULATORS

1-39. COOLING OIL RELIEF VALVE. (See Figure 1-9.)

1-40. The cooling oil relief valve is a spring-loaded, poppet-type valve installed in the control valve dump port which maintains cooling oil pressure at 8 PSI (0.56 kg/cm^2). Cooling oil is distributed through the hydraulic lines to the brake and clutches to remove excess heat. Discharge oil from the relief valve is dumped directly to the inside of the winch housing.

1-41. ACCUMULATOR VALVE. (See Figure 1-10.)

1-42. As the system builds up pressure during normal operation, oil can flow past the ball check in the valve and be stored in the accumulators under pressure. When the control spool moves into forward, reverse or BRAKE OFF a cam on the spool pushes on the accumulator valve pin and lifts the ball check off its seat to allow the release of the stored oil. If the PTO should tend to stall so that the hydraulic pump is not pumping sufficient oil, the stored oil will be released to release the brake and apply the clutch and avoid further drag on the PTO. To avoid low speed shift stall, increase engine speed to provide enough torque for the load demands.

NOTE In the event the vehicle PTO should stall, the brake can be released by moving the control lever to the Brake Off position which allows high pressure oil stored in the accumulators to release the brake.

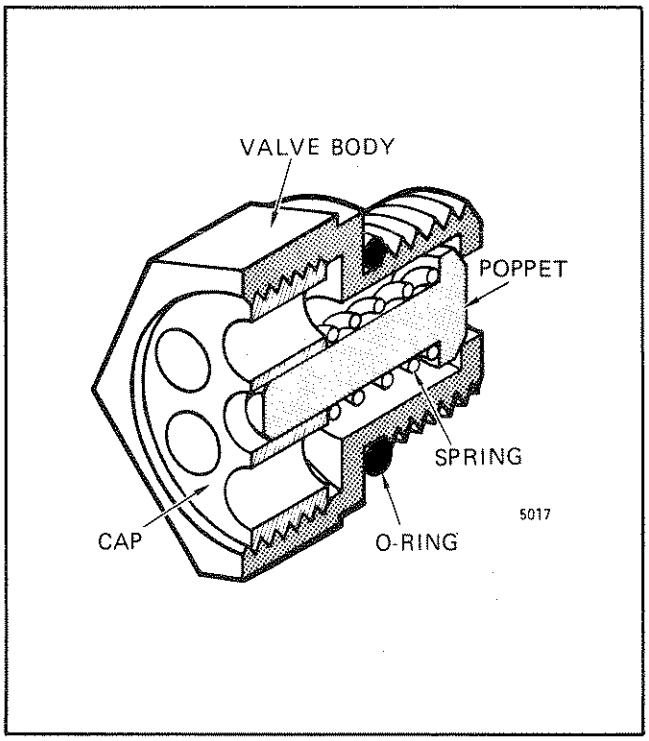


FIGURE 1-9. COOLING OIL RELIEF VALVE

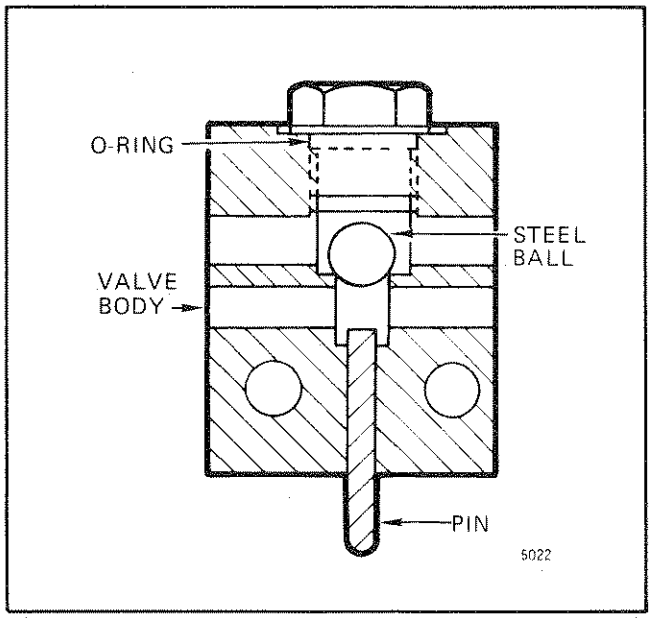


FIGURE 1-10. ACCUMULATOR VALVE

1-43. CONTROL LEVER ASSEMBLY.

1-44. Power-Forward/Reverse Winch (PFR). (See Figure 1-11.)

1-45. The control assembly for the Power-Forward/Reverse Winch has two control levers (one for Power control and one for FREE-SPOOL). The control assembly consists primarily of: (1) a housing, (2) two control levers, (3) a pivot pin, and (4) an oil pressure gauge. A push-pull cable connects the Power control lever to the winch control valve spool. A second push-pull cable is attached to the FREE-SPOOL control lever. The housing is normally mounted on the right-hand side of the operator's seat and positioned so that the control lever is pulled towards the operator for FORWARD (line in) and pushed away for REVERSE (line out). The pressure gauge indicates the operating brake release pressure. The FREE-SPOOL control lever is pulled toward the operator for FREE-SPOOL operation. If the FREE-SPOOL clutch does not fully engage, use the power control handlever to rotate the gears lightly to allow the FREE-SPOOL clutch to engage.

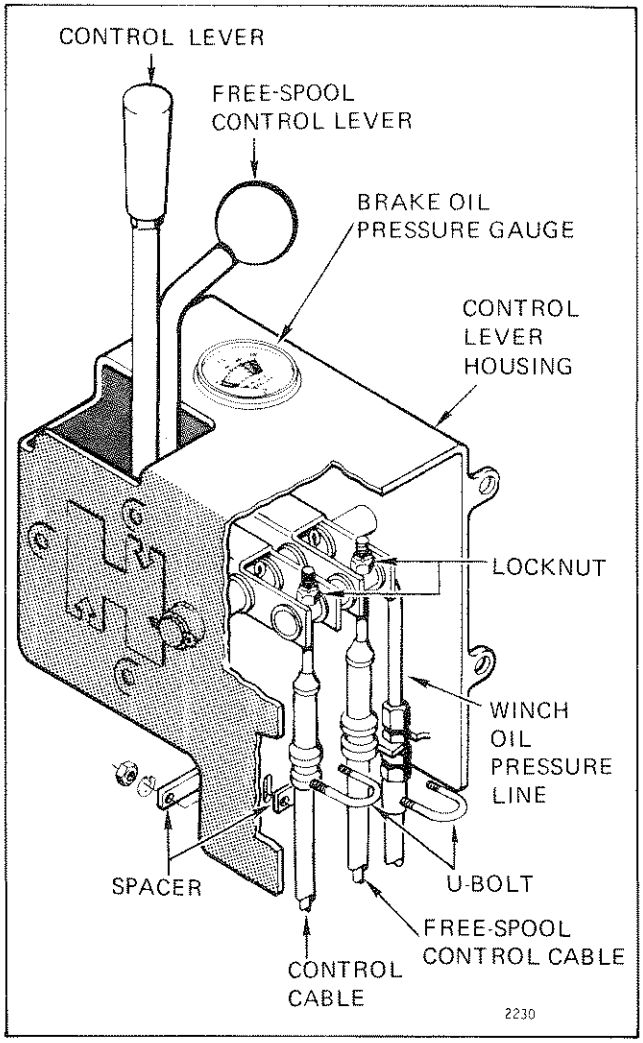


FIGURE 1-11. CONTROL LEVER ASSEMBLY, POWER-FORWARD/REVERSE WINCH (PFR)

NOTE When operating in FREE-SPOOL, the Power control lever should be in either the NEUTRAL or BRAKE-OFF position.

1-46. Power-Forward Only Winch (PFO). (See Figure 1-12.)

1-47. The control lever assembly for the Power-Forward Only Winch has only one control lever. The control lever assembly consists primarily of: (1) a housing, (2) control lever, (3) a pivot pin, and (4) an oil pressure gauge. A push-pull cable connects the control lever with the control valve spool. The housing is usually mounted on the right-hand side of the operator's seat and positioned so that the control lever is pulled towards the operator for FORWARD (line in) and pushed away for FREE-SPOOL. The pressure gauge indicates brake release pressure.

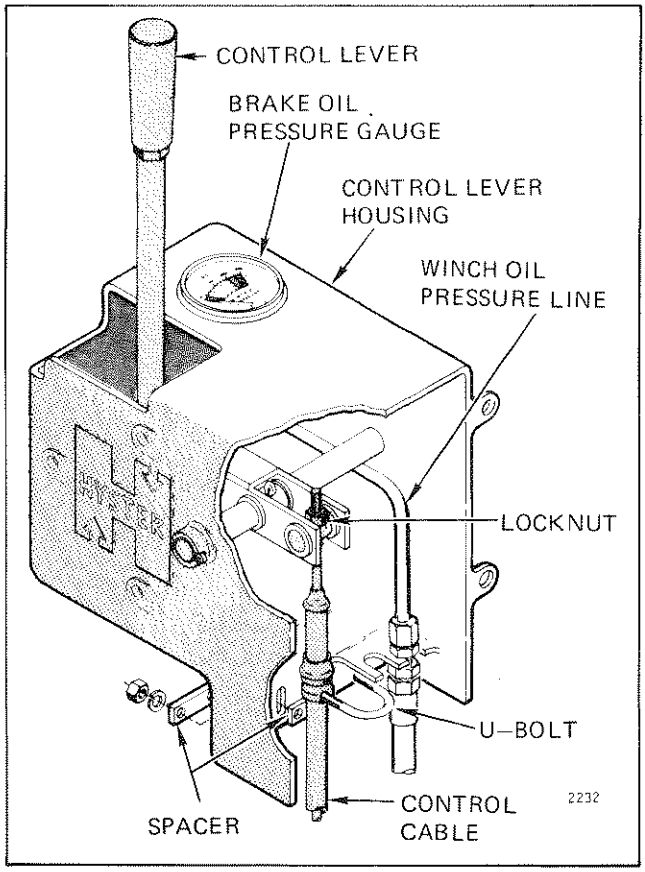
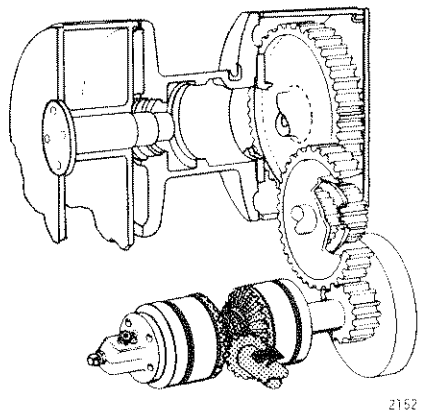
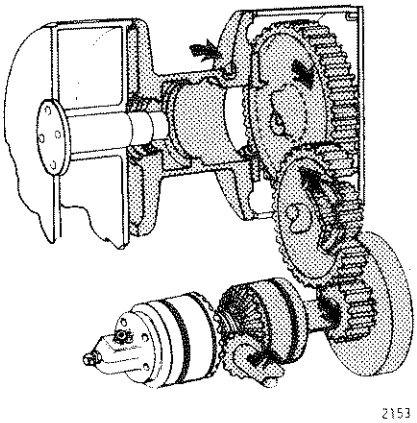


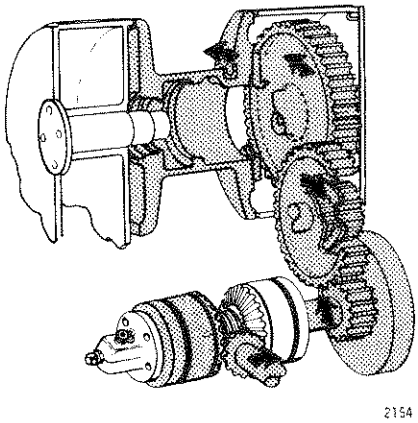
FIGURE 1-12. CONTROL LEVER ASSEMBLY, POWER-FORWARD ONLY WINCH (PFO)



NEUTRAL



FORWARD



REVERSE

FIGURE 1-13. TORQUE TRANSFER (PFR)

1-48. FUNCTIONAL DESCRIPTION.

1-49. Gear Train, Power-Forward/Reverse Winch (PFR). (See Figure 1-13.)

1-50. The PTO shaft assembly rotates clockwise as viewed from the front of the tractor. Torque is transferred from the PTO bevel pinion to the clutch carriers and bevel ring gears. This causes the carriers and bevel ring gears to rotate in opposite directions. In Neutral, neither clutch is engaged; therefore, the carrier and bevel gears rotate continuously while the intermediate pinion gear and brake shaft does not. In Forward, the forward oil clutch assembly is locked up to the bevel gear and brake shaft by hydraulic pressure from the control valve. The brake is also released by the hydraulic pressure. With the clutch engaged, torque is transferred to the intermediate pinion gear, which drives the intermediate gear and intermediate shaft assembly (drum pinion gear) clockwise. The drum pinion gear will now turn the large drum gear and drum counterclockwise. In Reverse, the reverse oil clutch assembly is locked up to the bevel gear and brake shaft by hydraulic pressure from the control valve. The brake is also released. Torque is now transferred to the intermediate pinion gear which drives the intermediate gear and intermediate shaft assembly (drum pinion gear) counter-clockwise. The drum pinion gear will now turn the large drum gear and drum clockwise.

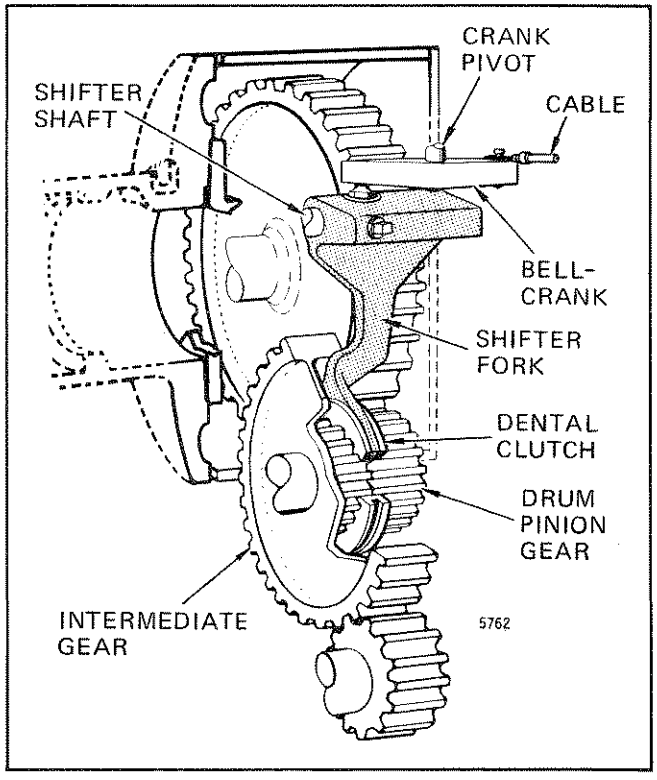
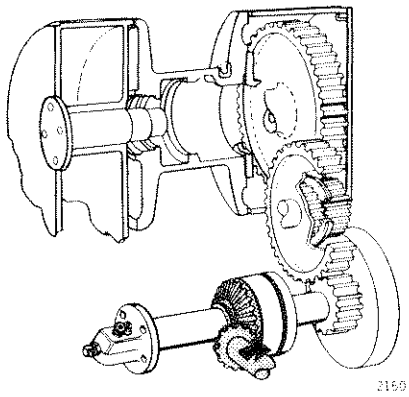
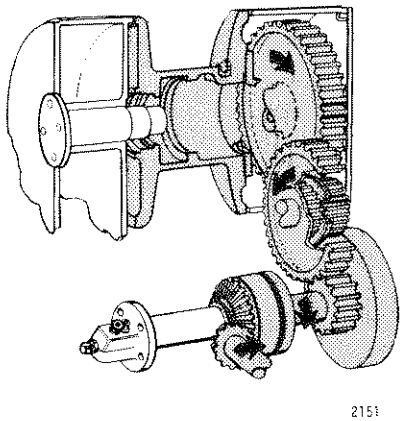


FIGURE 1-14. FREE-SPOOL ARRANGEMENT (PFR)



NEUTRAL



FORWARD

FIGURE 1-15. TORQUE TRANSFER (PFO)

When in FREE-SPOOLING (see Figure 1-14) the dental clutch is disengaged from the drum pinion gear through a mechanical linkage. Moving the FREE-SPOOL control lever to the FREE-SPOOL position pivots a cable operated bellcrank mounted inside the winch housing. A shifter fork, attached to the bellcrank by a ball stud, slides on a shaft mounted above the drum pinion gear. As the bellcrank pivots, it slides the shifter fork along the shaft, disengaging the dental clutch from the drum pinion gear. A detent ball and spring, fitted into the shaft, locks the shifter fork in the FREE-SPOOL or normal position. With the drum pinion gear disengaged from the gear train the drum can rotate freely. As the shifter fork is moved to the normal position, the dental clutch is moved so that it engages the drum pinion gear. At this time, the drum gear is mechanically connected to the remainder of the winch gear train. When in the normal position, the winch gear train controls the operation of the drum gear and drum.

1-51. Gear Train, Power-Forward Only Winch (PFO). (See Figure 1-15.)

1-52. The PTO shaft assembly rotates clockwise as viewed from the front of the tractor. Torque is transferred from the PTO bevel pinion gear to the clutch carrier and bevel ring gear. This causes the carrier and bevel ring gear to rotate counterclockwise. In Neutral, the clutch is not engaged; therefore, the carrier and bevel ring gear rotate continuously while the intermediate pinion gear and brake shaft does not. In Forward, the oil clutch assembly is locked up to the bevel gear and brake shaft by hydraulic pressure from the control valve. Torque is now transferred to the intermediate pinion gear, which drives the large intermediate gear and intermediate shaft assembly (drum pinion gear) clockwise. The drum pinion gear will now turn the large drum gear and drum counterclockwise. When in FREE-SPOOLING (see Figure 1-16) the dental clutch is disengaged from the drum pinion gear by a hydraulic actuator and shifter fork. Moving the control lever to the FREE-SPOOL position directs oil flow from the control valve to the hydraulic actuator. The shifter fork, attached to the

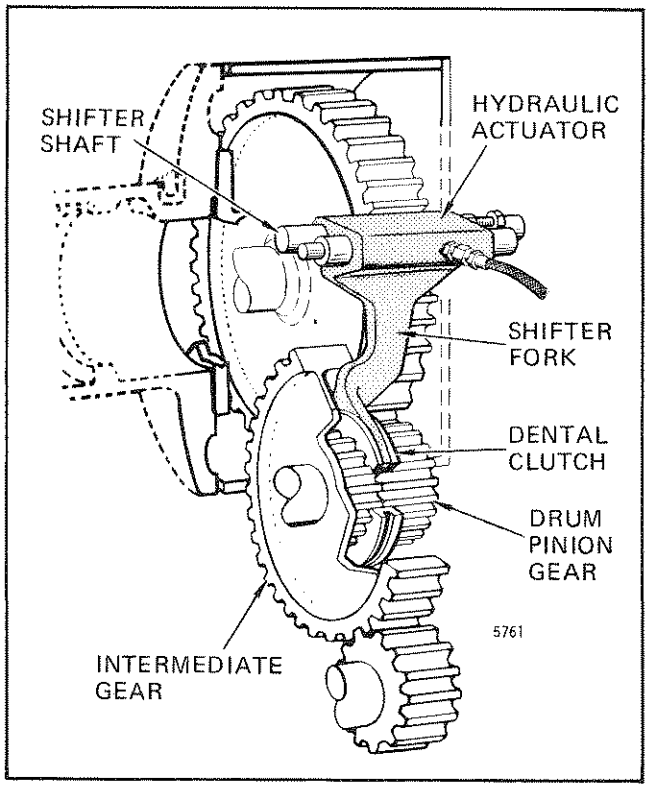


FIGURE 1-16. FREE-SPOOL ARRANGEMENT (PFO)

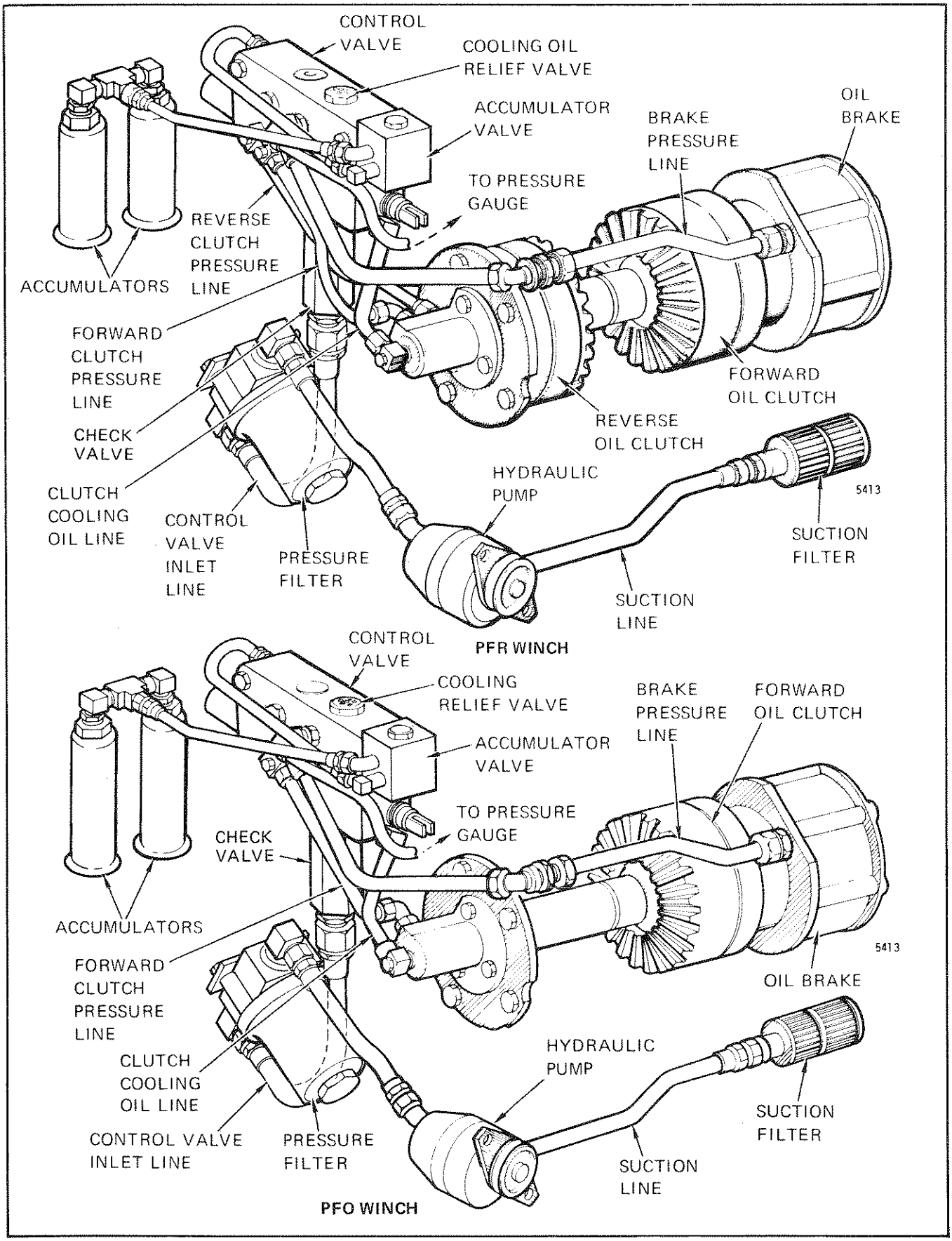


FIGURE 1-17. HYDRAULIC SYSTEM

hydraulic actuator, slides on a shaft mounted above the drum pinion gear. As the hydraulic actuator extends, it slides the shifter fork along the shaft, disengaging the dental clutch from the drum pinion gear. The hydraulic actuator is spring loaded to the engaged position. When the control lever is returned to the NEUTRAL position, the spring-loaded actuator moves the shifter fork to its normal position. As the shifter fork returns to the normal position, the dental clutch is moved so that it engages the drum pinion gear. At this time, the drum gear is mechanically connected to the remainder of the winch gear train. When in the normal position, the winch gear train controls the operation of the drum gear and drum.

1-53. Hydraulic System.

1-54. DESCRIPTION. (See Figure 1-17.)

1-55. The hydraulic system used for the winch is entirely contained within the winch. The suction and pressure filters remove contaminants from the oil. The hydraulic pump supplies pressurized oil for the system. The control valve distributes and regulates hydraulic oil flow to apply the clutches and release the brake while maintaining the cooling oil flow. The pressure gauge mounted in the control lever housing indicates brake realease pressure. A separate accumulator valve, mounted on the front of the control valve body, controls high pressure oil to and from the accumulators.

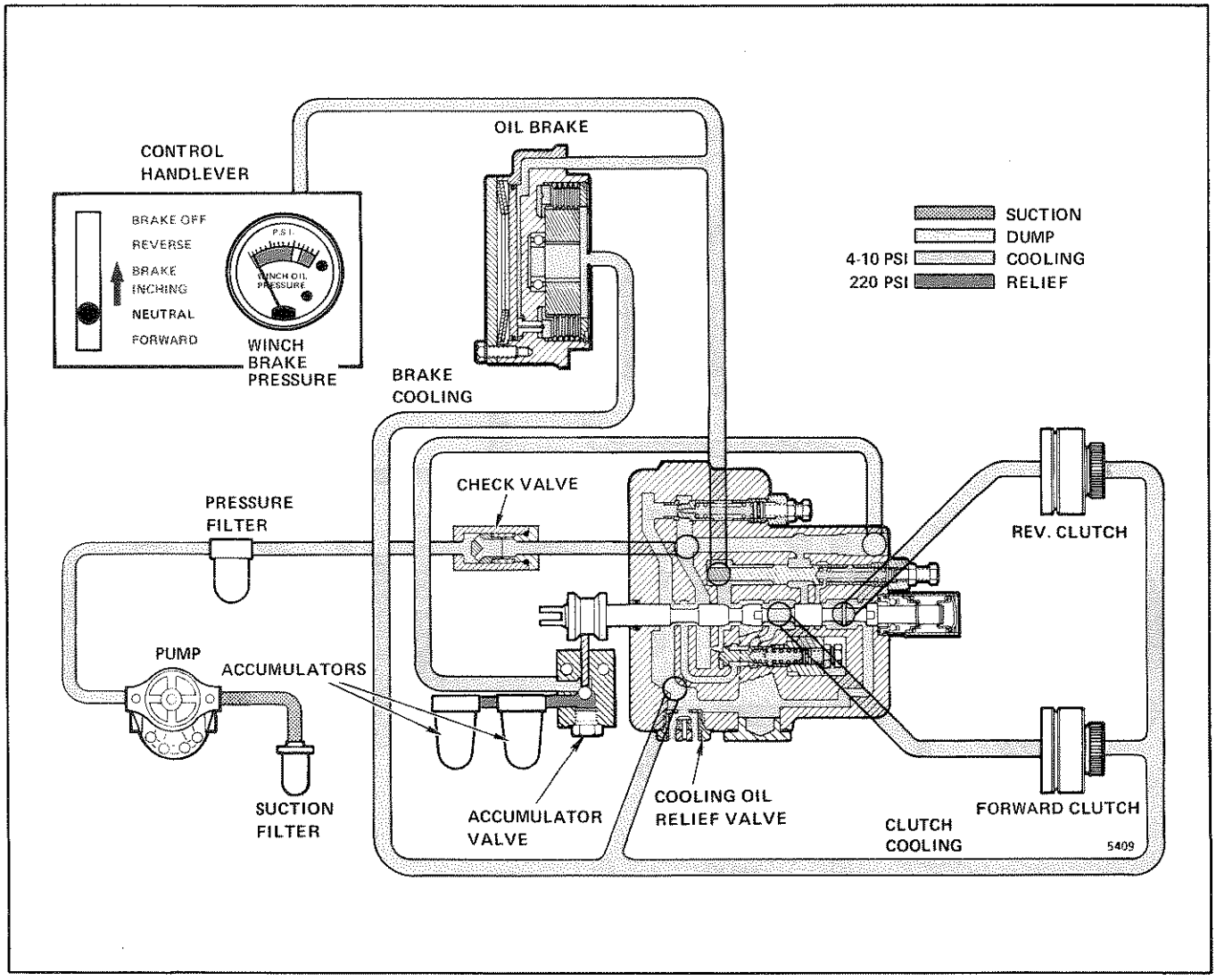


FIGURE 1-18. HYDRAULIC SYSTEM IN NEUTRAL

1-56. OPERATIONAL MODES, PFR WINCH.

1-57. There are five hydraulic modes of winch operation. These modes are as follows (refer to paragraphs 1-58 through 1-70.)

PFR WINCH
1. NEUTRAL
2. FORWARD (line in)
3. BRAKE INCHING (inching line out)
4. REVERSE (line out)
5. BRAKE OFF

1-58. NEUTRAL. (See Figure 1-18.)

1-59. The control valve spool is spring centered to NEUTRAL. In this position, oil entering the open-center valve flows into the low pressure core passages. The cooling oil relief valve maintains hydraulic pressure in the cooling oil passage.. Cooling oil flows out the cooling oil manifold to lubricate and cool the clutch and brake assemblies. Excess oil, even at low idle, flows out the cooling oil relief valve down the outside of the valve.

1-60. FORWARD OPERATION. (See Figure 1-19.)

1-61. For FORWARD (line in) operation, the operator pulls back on the lever which causes the spool to move into the valve closing off the flow of oil to the cooling passage. This allows a pressure buildup in the inlet passage. Oil flows from the inlet passage to the brake passage through an orifice producing a pressure drop between the inlet and brake passage depending on the amount of oil flow. As the brake port to sump is closed off by the spool, the oil flow to sump is reduced, allowing the brake pressure to build up. As the brake pressure increases, the forward modulator valve will regulate

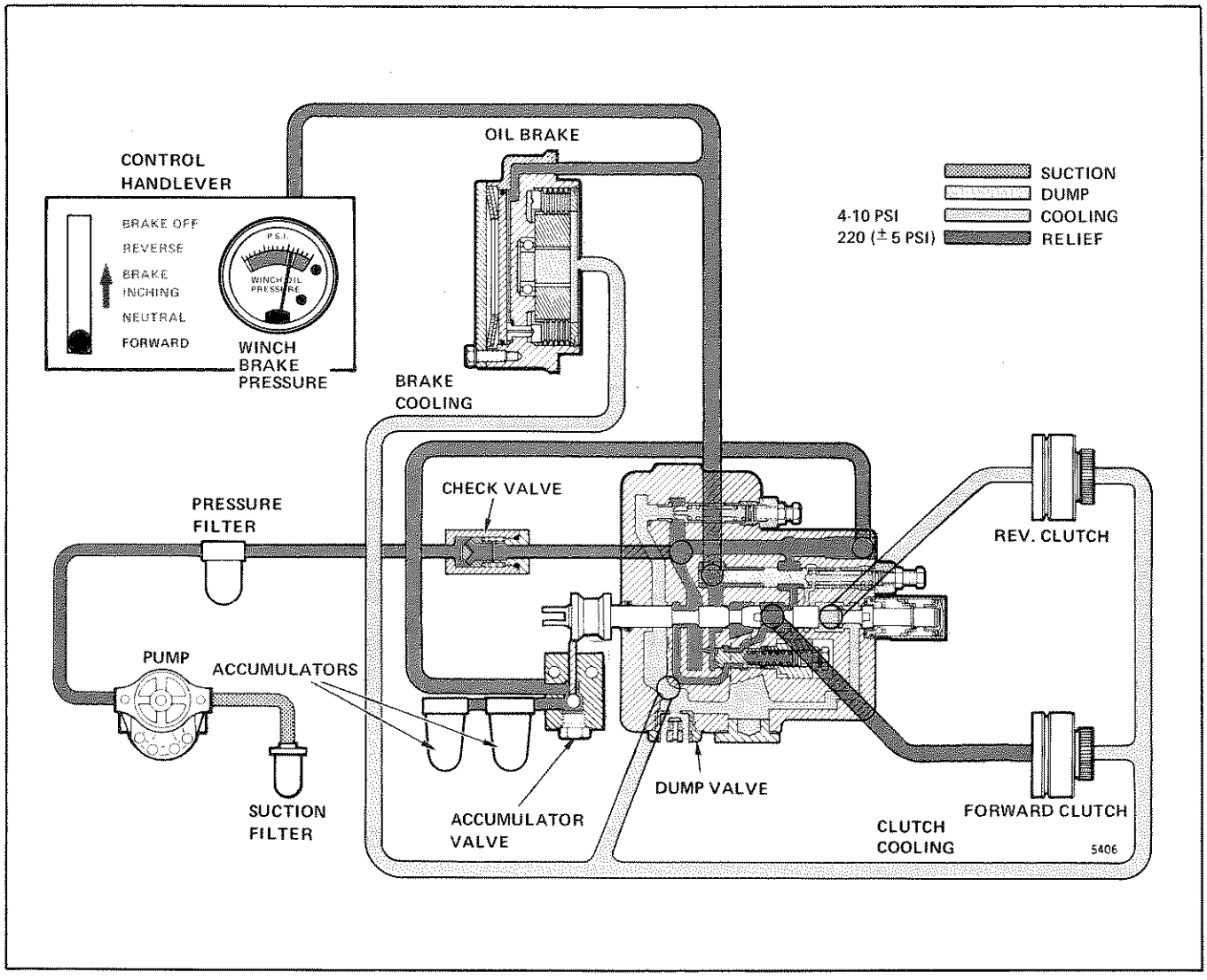


FIGURE 1-19. HYDRAULIC SYSTEM IN FORWARD

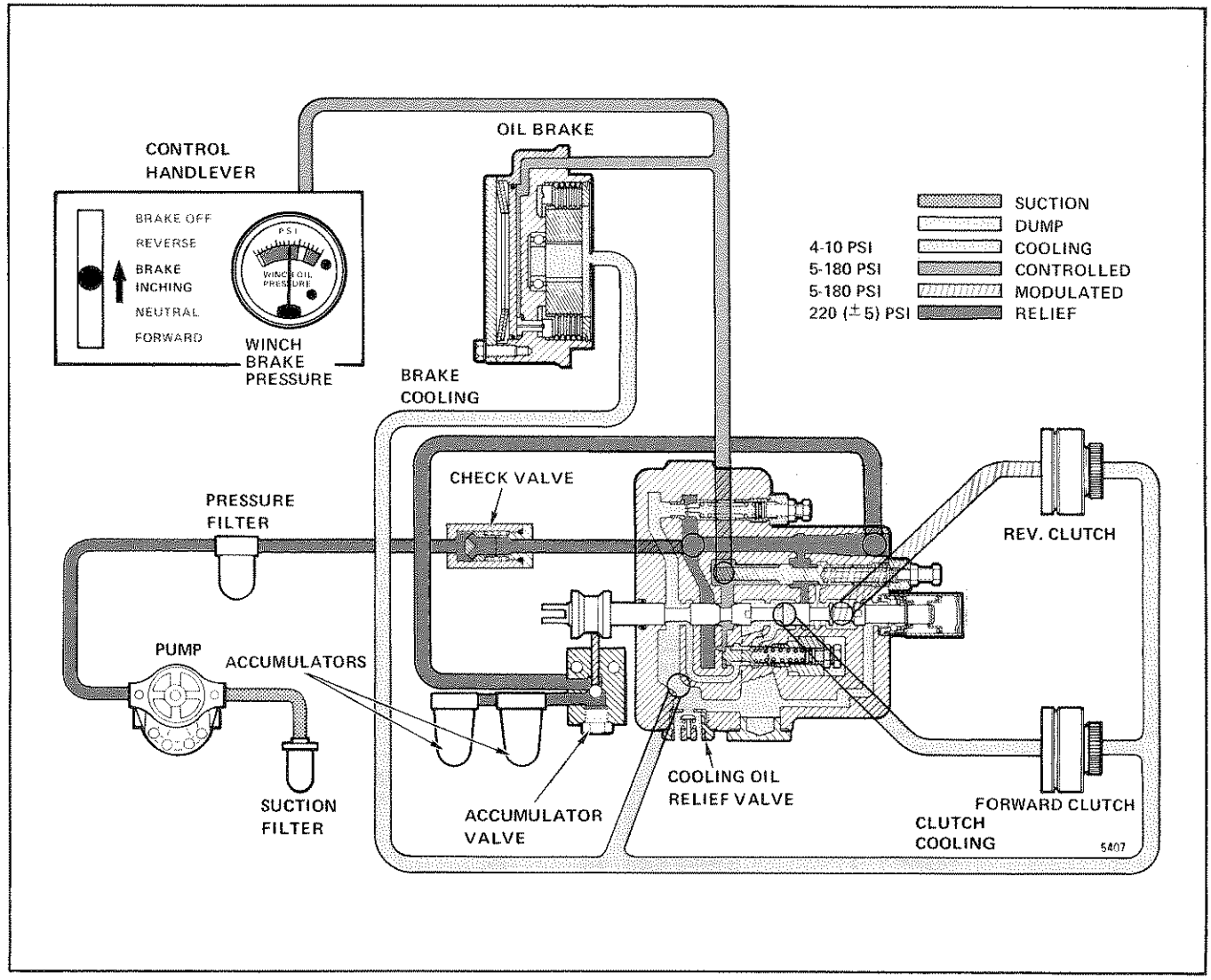


FIGURE 1-20. HYDRAULIC SYSTEM IN BRAKE INCHING

the oil pressure to the forward clutch and maintain a constant 80 PSI (5.63 kg/cm^2) pressure differential between brake and clutch through the inching mode. At the end of the spool travel, a direct port to the clutch is opened and the clutch and brake fill simultaneously.

NOTE On a fast shift, the spool moves into the full forward position routing oil directly to the forward clutch bypassing the forward modulator valve completely, thereby avoiding any delay in operation.

1-62. When pressure starts to rise above 220 ± 5 PSI (15.5 ± 0.35 kg/cm^2) at the inlet port passage, the spring-loaded poppet in the relief valve will bypass the excess pressure to the cooling oil passage. An orifice in the relief valve poppet prevents oil from becoming trapped behind the poppet and causing a hydraulic lock.

1-63. BRAKE INCHING OPERATION. (See Figure 1-20.)

1-64. BRAKE INCHING (gradual brake release) is achieved by slowly pushing the control lever out of the Neutral position toward the Reverse position. As the control spool moves, the flow of oil to the cooling oil passage is blocked. This allows pressure to build up in the inlet passage. Oil flows from the inlet passage to the brake passage through an orifice producing a pressure drop between the inlet and brake passages depending on the amount of

oil flow. As the brake port to sump is closed off by the spool, the oil flow to sump is reduced, allowing the brake pressure to build up. As the brake pressure increases, the reverse modulator valve will regulate the oil pressure to the reverse clutch and maintain a constant 80 PSI (5.63 kg/cm²) pressure differential between brake and clutch through the inching mode.

1-65. Relief valve operation is the same as described in paragraph 1-62.

1-66. REVERSE OPERATION. (See Figure 1-21.)

1-67. REVERSE (line out) is achieved by pushing the control lever to the Reverse position, thereby pulling the control spool out. As the spool moves, the flow conditions in the valve are as described in paragraph 1-64. At the end of the spool travel, a direct port to the reverse clutch is opened.

NOTE On a fast shift, the spool moves into the full reverse position routing oil directly to the reverse clutch bypassing the reverse modulator valve completely, and thereby avoiding any delay in operation.

1-68. Relief valve operation is the same as described in paragraph 1-62.

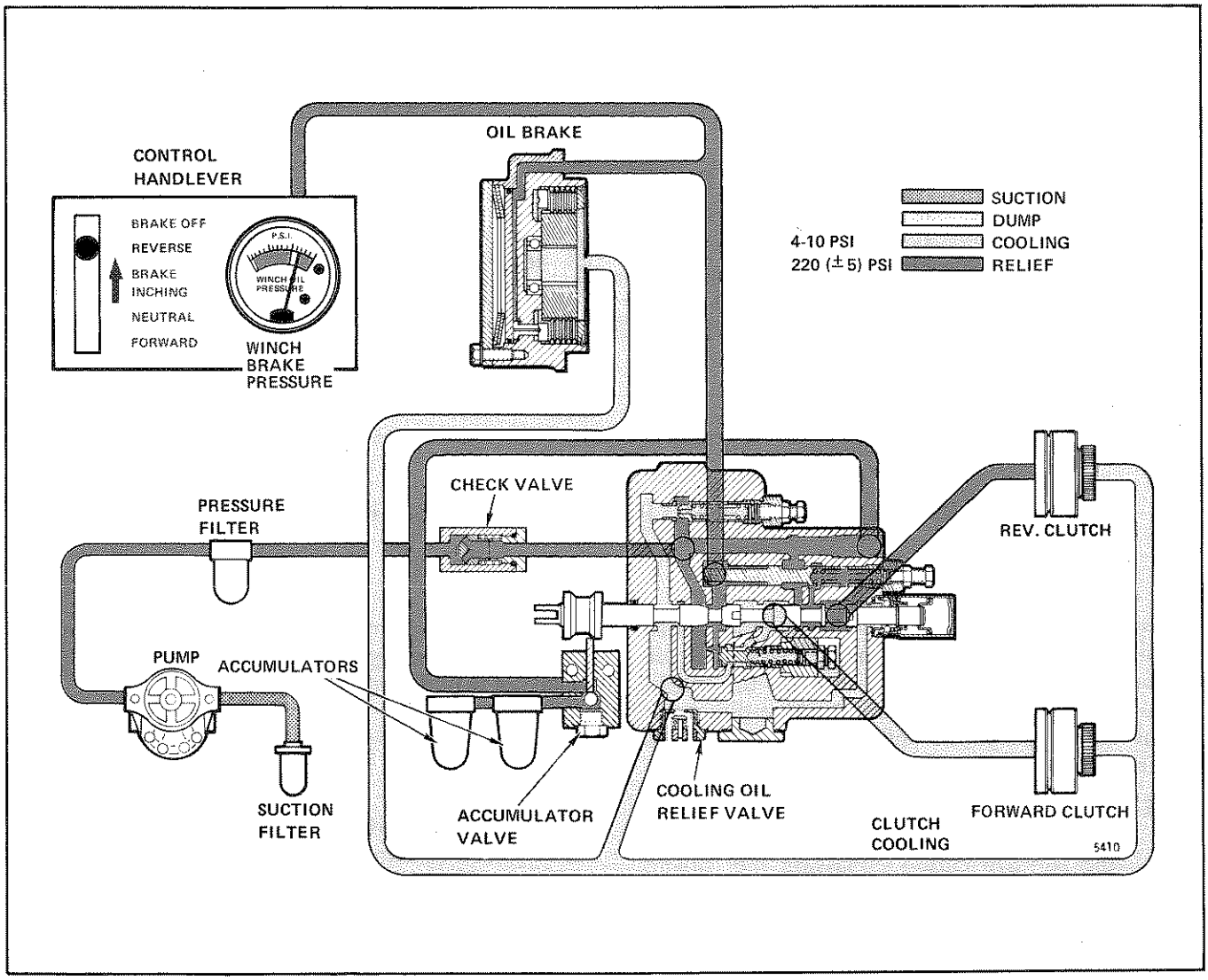


FIGURE 1-21. HYDRAULIC SYSTEM IN REVERSE

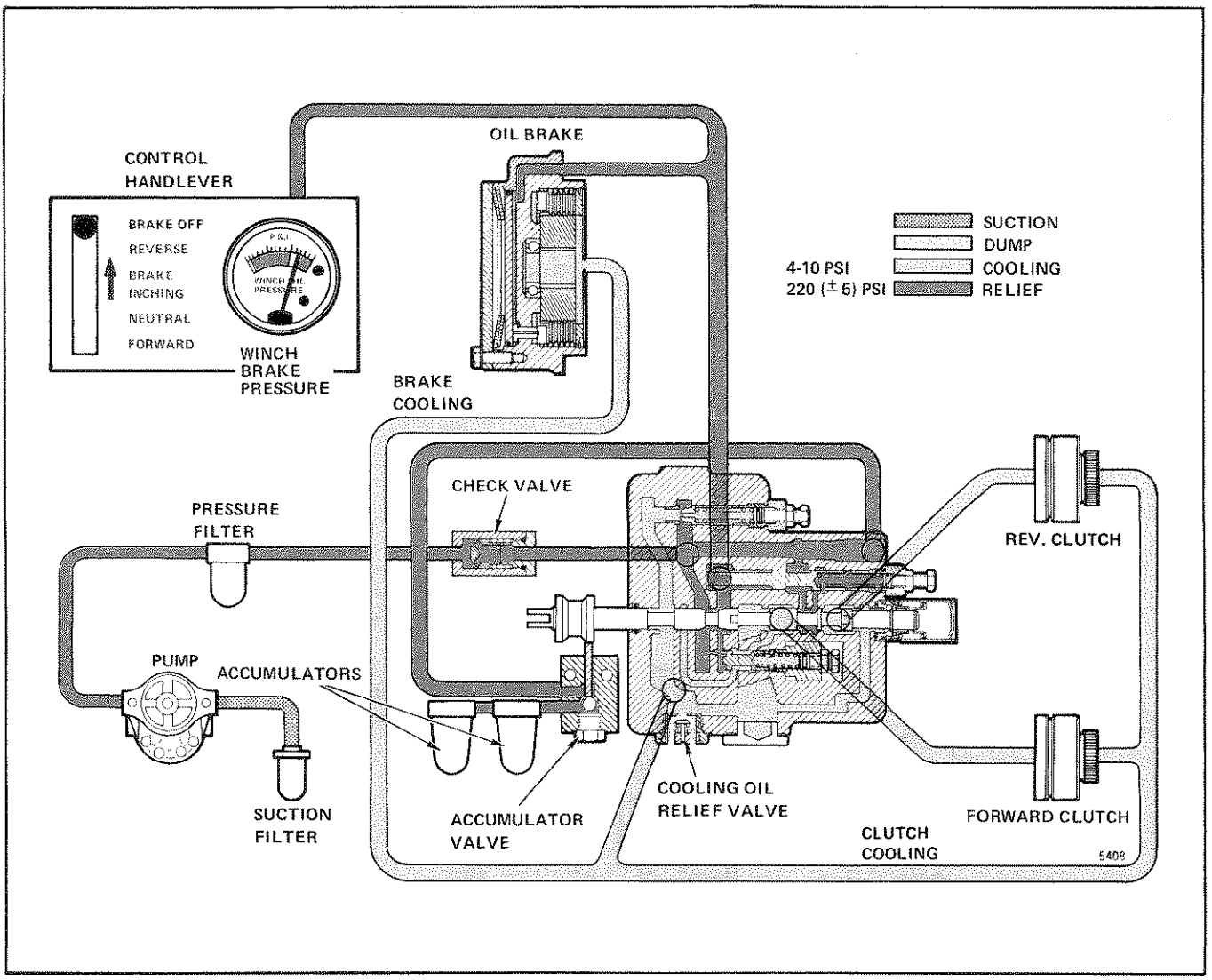


FIGURE 1-22. HYDRAULIC SYSTEM IN BRAKE OFF

1-69. BRAKE OFF OPERATION. (See Figure 1-22.)

1-70. BRAKE OFF is achieved by pushing the control lever all the way to the BRAKE OFF position. This position is detented and the control lever must be moved manually to return it to the Neutral position. With the control spool in the BRAKE OFF position, oil flow to the clutches is blocked and high pressure oil flows directly to the brake port to fully release the brake.

1-71. OPERATIONAL MODES, PFO WINCH.

1-72. There are five modes of winch operation. These modes are as follows (refer to paragraphs 1-71 through 1-84):

PFO WINCH
1. NEUTRAL
2. FORWARD (line in)
3. BRAKE INCHING (inching line out)
4. BRAKE OFF
5. FREE-SPOOL (line out)

1-73. NEUTRAL. (See Figure 1-23.)

1-74. The control valve spool is spring centered to NEUTRAL. In this position, oil entering the open-center valve flows into the low pressure core passages. The cooling oil relief valve maintains hydraulic pressure in the cooling oil passage at 8 PSI (0.56 kg/cm^2). Cooling oil flows out the cooling oil manifold to lubricate and cool the clutch and brake assemblies. Excess flow goes directly to the sump.

1-75. FORWARD OPERATION. (See Figure 1-24.)

1-76. For FORWARD (line in) operation, the operator pulls back on the lever which causes the spool to move into the valve closing off the flow of oil to the cooling passage. This allows a pressure buildup in the inlet passage. Oil flows from the inlet passage to the brake passage through an orifice producing a pressure drop between the inlet and brake passage depending on the amount of oil flow.

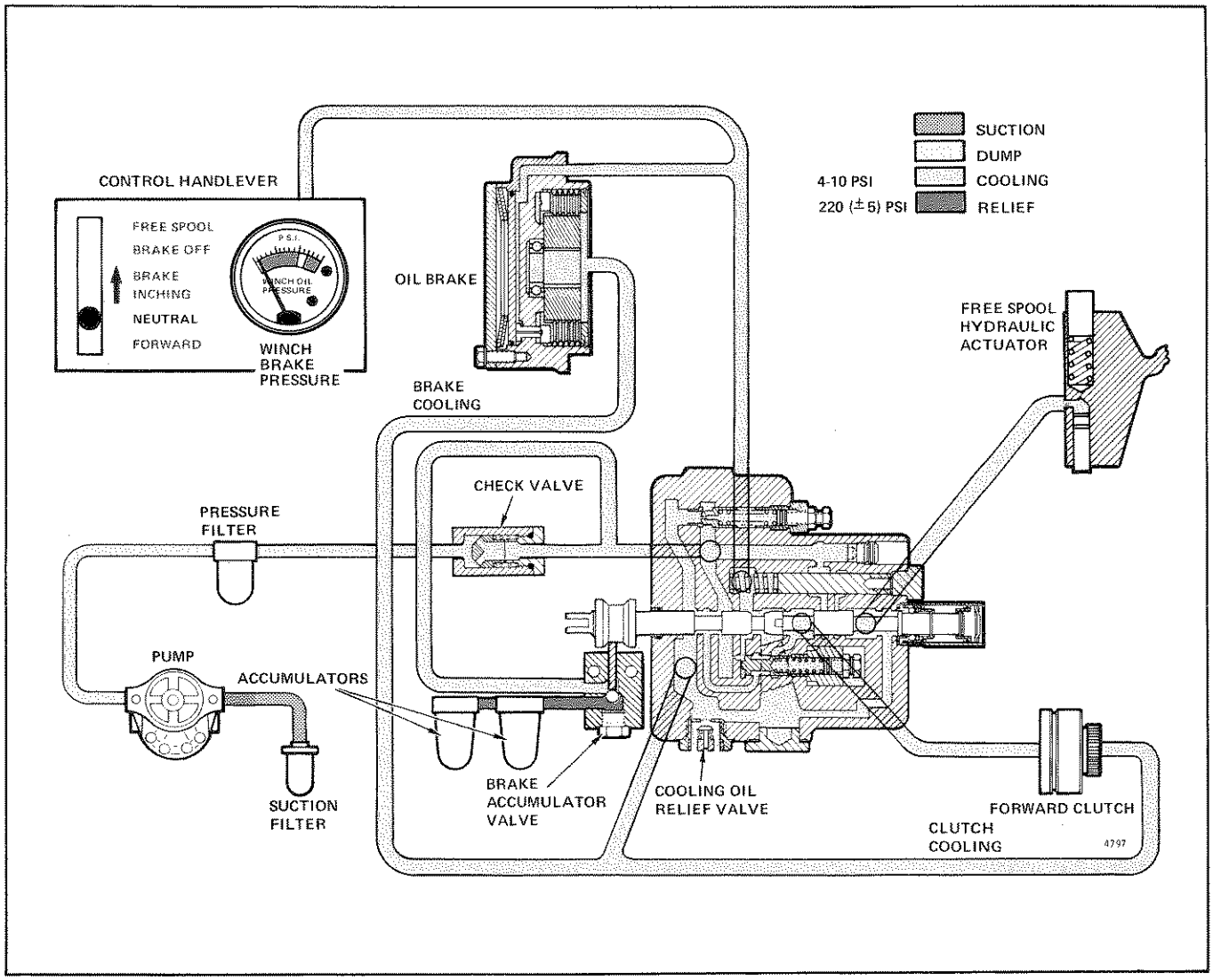


FIGURE 1-23. HYDRAULIC SYSTEM IN NEUTRAL

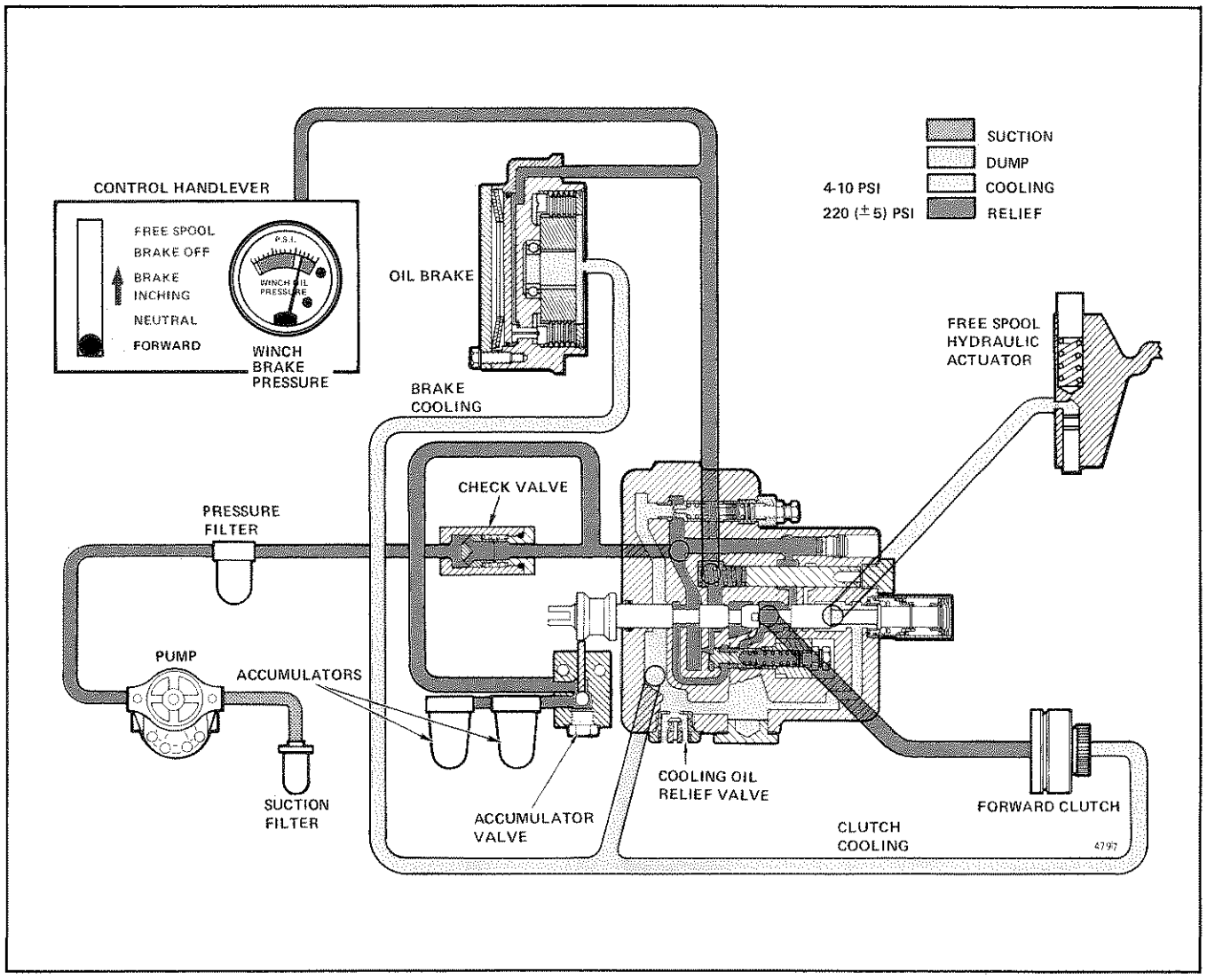


FIGURE 1-24. HYDRAULIC SYSTEM IN FORWARD

As the brake port to sump is closed off by the spool, the oil flow to sump is reduced, allowing the brake pressure to build up. As the brake pressure increases, the forward modulator valve will regulate the oil pressure to the forward clutch and maintain a constant 80 PSI (5.63 kg/cm^2) pressure differential between brake and clutch through the inching mode. At the end of the spool travel, a direct port to the clutch is opened.

NOTE On a fast shift, the spool moves into the full forward position routing oil directly to the forward clutch, bypassing the forward modulator valve completely, thereby avoiding any delay in operation.

1-77. When pressure starts to rise above 220 ± 5 PSI (15.5 ± 0.35 kg/cm^2) at the inlet port passage, the spring-loaded poppet in the relief valve will bypass the excess pressure to the cooling oil passage. An orifice in the relief valve poppet prevents oil from becoming trapped behind the poppet and causing a hydraulic lock.

1-78. BRAKE INCHING OPERATION. (See Figure 1-25.)

1-79. BRAKE INCHING (gradual brake release) is achieved by slowly pushing the control lever out of the Neutral position toward the Brake Off position. As the control spool moves, the flow of oil

to the cooling oil passage is blocked. This allows pressure to gradually build up in the inlet passage. Oil flows from the inlet passage to the brake passage through an orifice producing a pressure drop between the inlet and brake passages depending on the amount of oil flow. As the brake port to sump is closed off by the spool, the oil flow to sump is reduced, allowing the brake release pressure to increase.

1-80. Relief valve operation is the same as described in paragraph 1-77.

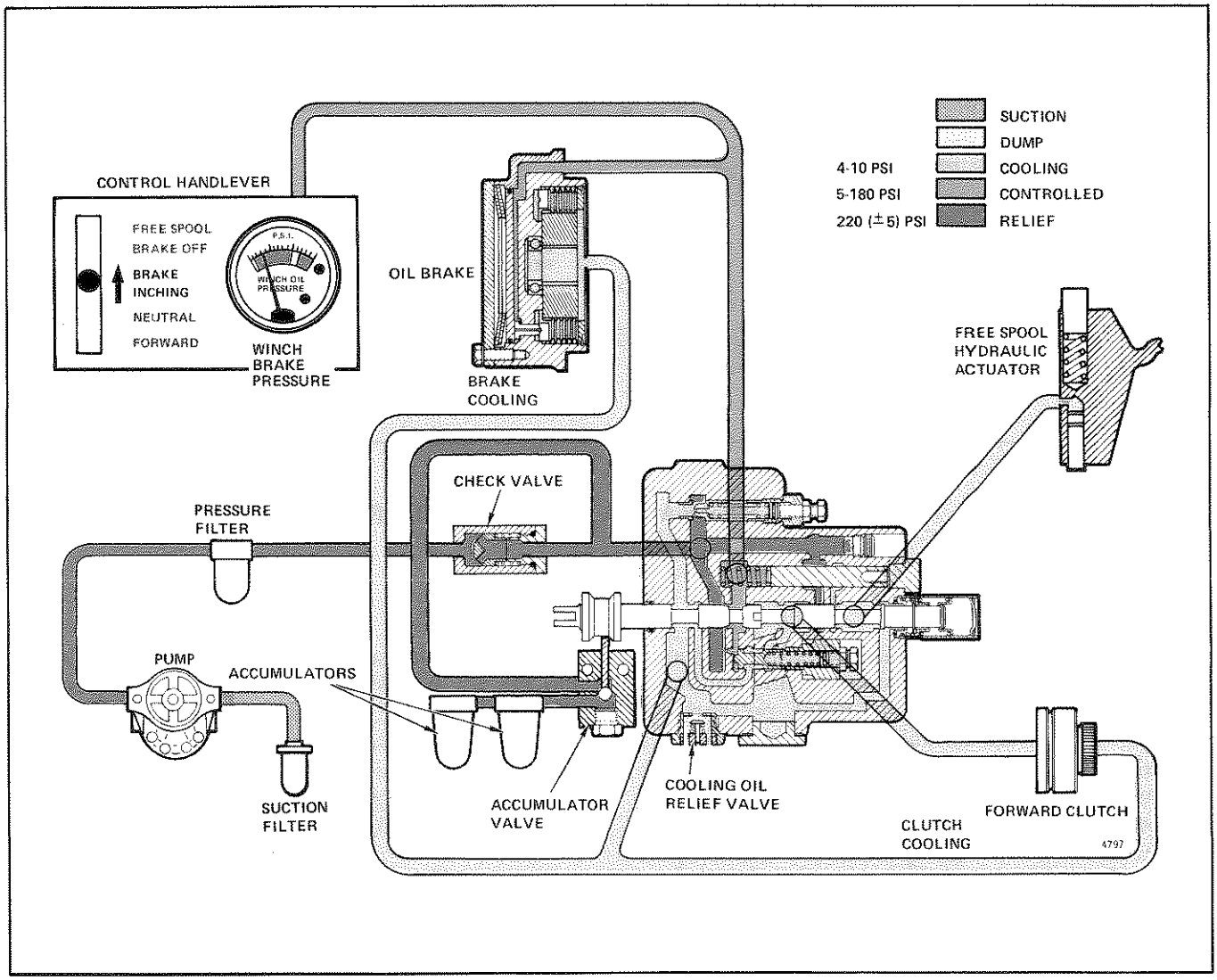


FIGURE 1-25. HYDRAULIC SYSTEM IN BRAKE INCHING

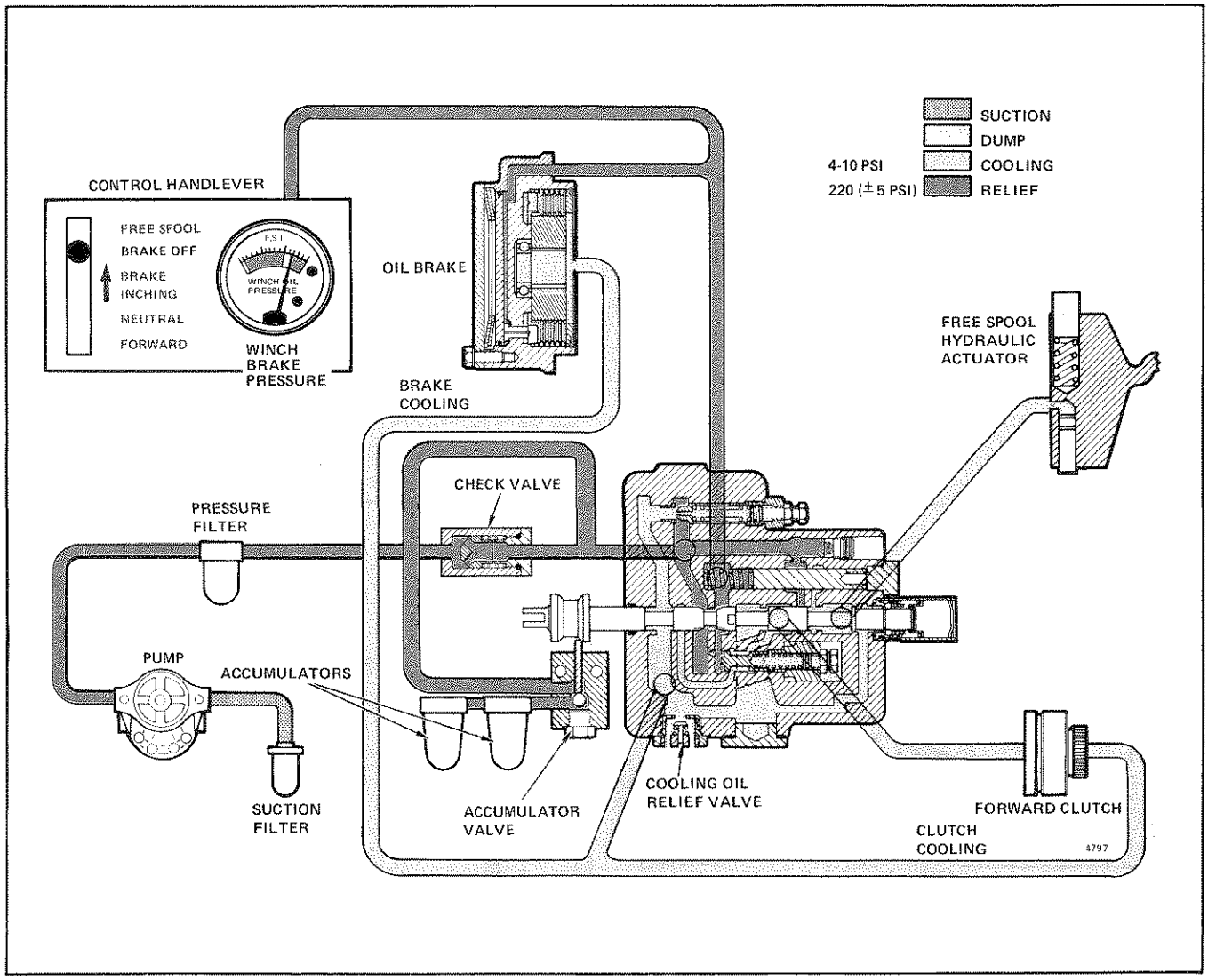


FIGURE 1-26. HYDRAULIC SYSTEM IN BRAKE OFF

1-81. BRAKE OFF OPERATION. (See Figure 1-26.)

1-82. BRAKE OFF is achieved by pushing the control lever to the BRAKE OFF position, thereby pulling the control spool out. As the spool moves, the flow conditions in the valve are as described in paragraph 1-79. At the end of the spool travel, a direct port to the brake is opened and high pressure oil fully releases the brake.

1-83. FREE-SPOOL OPERATION (See Figure 1-27.)

1-84. The system is placed in FREE-SPOOL by pushing the control lever all the way to the FREE-SPOOL position. This position is detented and the control lever must be moved manually to return it to the Neutral position. With the control spool in the FREE-SPOOL position, oil flows to the brake and directly to the hydraulic actuator for disengaging the drum pinion gear. The free-spool actuator operating pressure is limited by the relief valve as described in paragraph 1-77.

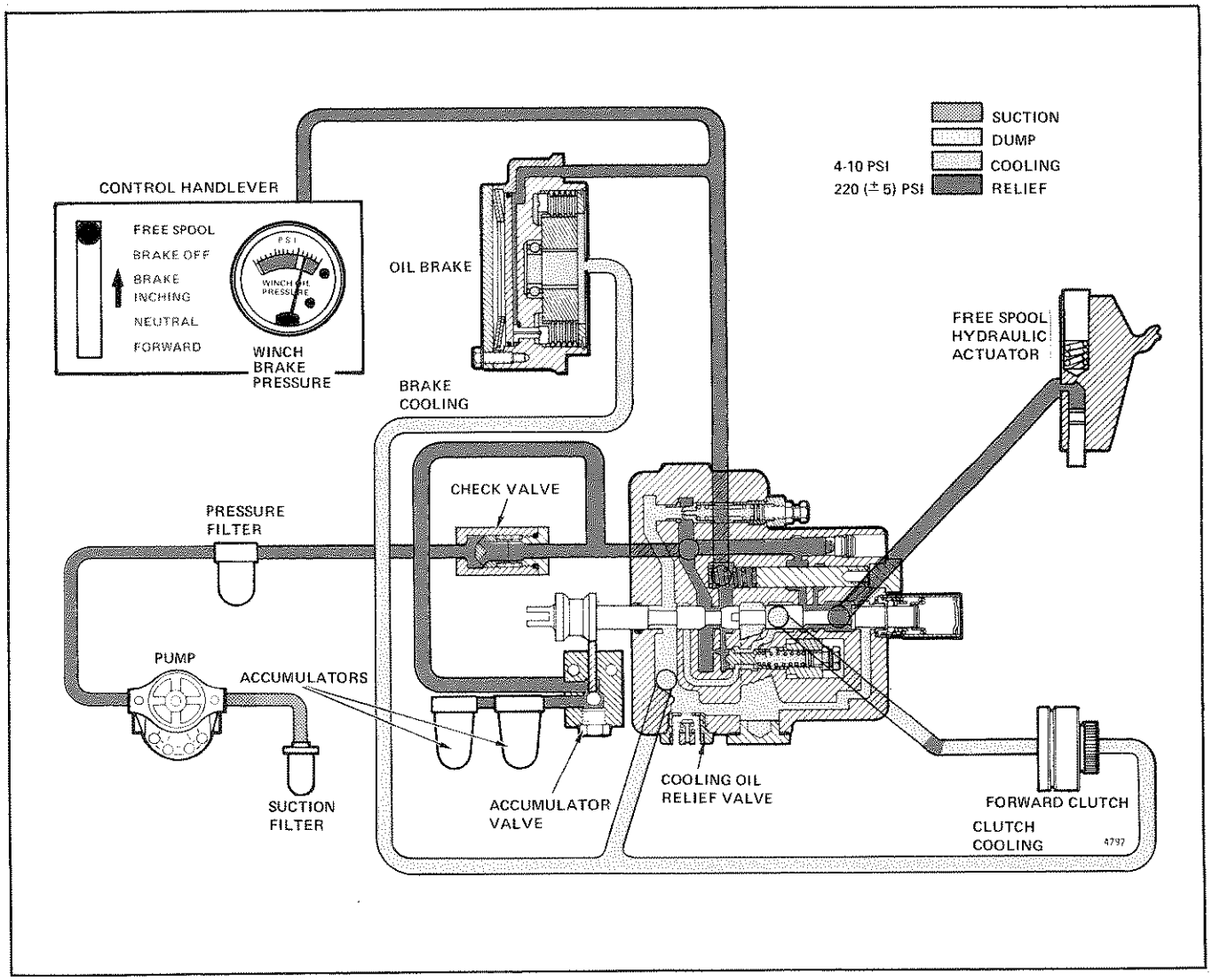


FIGURE 1-27. HYDRAULIC SYSTEM IN FREE-SPOOL

2-1. GENERAL.

2-2. The W5A winch uses vehicle mounted controls. These controls allow the operator to either reel-out or reel-in line easily without leaving the vehicle. Every operator must know the exact operating procedure of these controls prior to operating the winch.

2-3. OPERATIONAL PRECAUTIONS.

2-4. Observe the following PRECAUTIONS to prevent injury to personnel and damage to equipment:

a. Do not operate winch unless vehicle is equipped with a rear screen for operator protection against cable breakage.

b. Report damage or erratic operation of winch or pressure gauge immediately.

c. Do not stand while operating the vehicle or winch.

d. Make sure that instruments and controls are operative before working the unit.

e. Do not use control levers or handles as machine mounting assists.

f. Do not use control levers or handles as hangers for clothes, water bags, grease guns, lunch pails, etc.

g. Do not permit personnel in the control area when working or making checks on the machine.

h. Do not allow riders on the machine or load.

i. Use extreme care when operating close to other machines.

j. Avoid operating near anyone working or standing.

k. Do not stand or permit others to stand in the bight (loop) of a cable.

l. Do not stand or permit others to stand near the winch or cable when it is under tension.

m. Do not work a damaged cable (broken wire or strands, or a decrease in the diameter of the cable are warning signs).

n. Do not leave the vehicle while the winch line is under tension.

o. Avoid pulling the hook over the drum and through the throat of the winch.

p. Do not anchor a double or two-part line to the winch.

q. When not operating the winch, always leave it in neutral with the brake on.

r. Never attempt to clean, oil or adjust a machine while it is in motion.

s. Authorized operators only!

t. Use extreme care when removing the cable and ferrule from the drum. When ferrule is released, the cable may spring out with force.

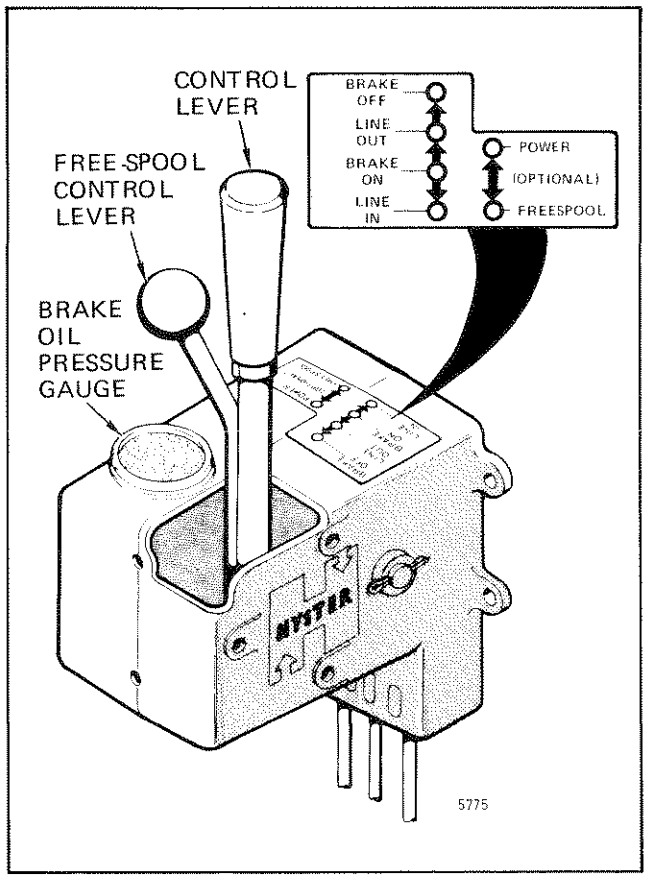


FIGURE 2-1. OPERATING CONTROLS FOR POWER-FORWARD/REVERSE WINCH (PFR)

2-5. OPERATING PROCEDURES.

2-6. Power-Forward/Reverse Winch (PFR). (See Figure 2-1.)

2-7. Two winch control levers are used (one for Power control and one for FREE-SPOOL). The Power control lever is used to select any one of five modes of operation: NEUTRAL, FORWARD (line in), BRAKE INCHING (gradual brake release), REVERSE (line out) and BRAKE OFF. The FREE-SPOOL control lever allows line to be pulled off the drum by hand. To operate the winch proceed as follows:

POWER CONTROL LEVER

a. NEUTRAL. The control lever is spring-centered to NEUTRAL and will remain in this position until moved by hand. The control lever will automatically return to NEUTRAL from any position, except BRAKE OFF. In NEUTRAL, the brake is fully applied. The winch oil pressure gauge will be in the lower green zone.

b. FORWARD. Pull the control lever all the way to the left (toward the operator) to the FORWARD position and hold. In FORWARD, the brake is completely released, the forward clutch engages, and the drum will reel-in line at a rate dependent on the load and vehicle engine speed. The winch oil pressure gauge will be in the upper green zone.

NOTE FORWARD INCHING is available by varying the control lever position between neutral and forward.

c. BRAKE INCHING. The BRAKE INCHING position is useful where a fine control for paying-out line is required. Ease the control lever slowly to the right (away from the operator) through BRAKE INCHING. This will gradually release the brake giving a more precise control of brake pressure. As the brake nears the release point, the winch reverse clutch will assume control of the load to inch line out under power. The winch oil pressure gauge will rise from the lower green zone, pass through the red zone, and remain in the upper green zone as the control lever approaches REVERSE.

d. REVERSE. Push the control lever to the right (away from the operator) until a stop is felt. Hold in this position.

IN REVERSE, the brake is completely released, the reverse clutch is engaged, and the drum will reel-out line. The winch oil pressure gauge will rise quickly through the red zone to the upper green zone.

e. BRAKE OFF. Push the control lever all the way to the right (away from the operator) into the BRAKE OFF detent position. The control lever will remain in this position until manually pulled out of the detent. The winch oil pressure gauge will be in the upper green zone.

FREE-SPOOL CONTROL LEVER

CAUTION FREE-SPOOL is to be used only when the line is slack.

a. FREE-SPOOLING. Move the control lever (toward the operator) into the FREE-SPOOL position with the Power control lever in NEUTRAL. This will disengage the dental clutch. At this time, the drum pinion gear is disengaged and the drum will rotate freely. To come out of FREE-SPOOL, move the lever away from the operator. If the den-

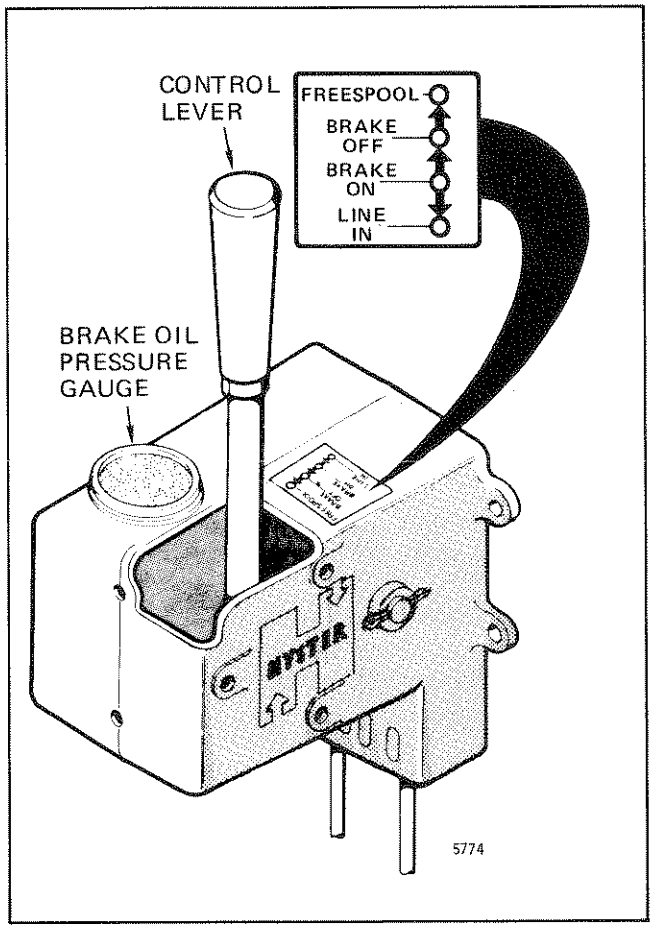


FIGURE 2-2. OPERATING CONTROL FOR POWER-FORWARD ONLY WINCH (PFO)

tal clutch does not fully engage, use the Power Lever to rotate the gears slightly to allow the dental clutch to engage.

2-8. Power-Forward Only Winch (PFO). (See Figure 2-2.)

2-9. A single control lever is used to select any one of five modes of operation: NEUTRAL, FORWARD (line in), BRAKE INCHING (gradual brake release), BRAKE OFF, and FREE-SPOOL. FREE-SPOOL allows line to be payed-out by hand. To operate the winch, proceed as follows:

a. NEUTRAL. The control lever is spring-centered to NEUTRAL and will remain in this position until moved by hand. The control lever will automatically return to NEUTRAL from any position, except FREE-SPOOL. In NEUTRAL, the brake is fully applied. The winch oil pressure gauge will be in the lower green zone.

b. FORWARD. Pull the control lever all the way to the left (toward the operator) to the FORWARD position and hold. In FORWARD, the brake is completely released, the forward clutch engages, and the drum will haul-in line at a rate dependent on the load and vehicle engine speed. The winch oil pressure gauge will be in the upper green zone.

NOTE FORWARD INCHING is available by varying the control lever position between neutral and forward.

c. BRAKE INCHING. Ease the control lever slowly to the right (away from the operator) through BRAKE INCHING. This will gradually release the brake giving a more precise control of brake pressure. The winch oil pressure gauge will rise from the red zone, and remain in the upper green zone as the control lever approaches BRAKE OFF.

d. BRAKE OFF. Push the control lever to the right (away from the operator) until a stop is reached. This will release the brake. The winch oil pressure gauge will be in the upper green zone.

e. FREE-SPOOL. Move the control lever all the way to the right (away from the operator) into the FREE-SPOOL position detent. This will disengage the drum pinion gear and allow the drum to rotate freely. To come out of FREE-SPOOL return the control lever to NEUTRAL.

CAUTION FREE-SPOOL is to be used only when the line is slack.

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3-1. GENERAL.

3-2. Table 3-1 is a trouble analysis check chart that includes the most common troubles that may be encountered, the probable cause of the trouble, and the corrective action that should be taken to restore the winch to a normal operating condition.

TABLE 3-1. TROUBLE ANALYSIS CHECK CHART (Sheet 1 of 5)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Winch Inoperative	Low oil level	Add oil
	Hydraulic line leaks.	Check for leaks.
	Stuck relief valve.	Clean and replace.
	Broken pump drive chain.	Repair chain.
	Broken PTO shaft.	Replace shaft.
Erratic Operation	Low oil level.	Add oil as necessary. Refer to Table 4-1.
	Push-pull cable out of adjustment.	Check for proper adjustment as outlined in Section 4. Adjust if necessary. Double check push-pull cable housing to be sure it is securely anchored on both ends.
	Tractor engine idling too low.	Adjust to correct idle RPM.
	Oil Viscosity too high.	Drain oil and refill with specified hydraulic oil. Refer to Table 4-1.
	Oil too cold.	Place control lever in brake-off position and allow oil to warm before operating the winch.
	Low oil pressure.	Refer to LOW OIL PRESSURE troubleshooting procedures.
Winch Stalls During Low RPM Shift	No accumulator charge	1. Recharge accumulators with oil as per Par. 4-20. 2. Check accumulator as per Par 4-34.
	Pressure modulator set too low.	Turn modulator screw in to set sooner brake release.
	Pressure modulater set too high.	Back modulator screw out to increase clutch pressure rate of fill.
Inadvertent Brake Release During Shift	Slow shift.	Back modulator screw out.
	Fast shift	Remove brake cover shims as required.

TABLE 3-1. TROUBLE ANALYSIS CHECK CHART (Sheet 2 of 5)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Brake Slippage	Inadequate spring tension.	Remove brake cover shims.
	Worn friction discs.	Replace.
	Bellville springs installed upside down.	Install properly. See Figure 5-17.
	Broken Bellville springs.	Replace.
Low Oil Pressure	Refer to ERRATIC OPERATION trouble-shooting procedures.	
	Leaking pressure hoses and fittings.	Check for leaks and replace components where necessary. Especially check line from valve to brake.
	Pressure filter leak.	Replace.
	Rupture accumulator.	Replace.
	Suction screen plugged.	Clean.
	Defective or improperly adjusted relief valve.	Check relief valve setting with pressure gauge as outlined in Section 4. Replace Relief Valve Assembly if defective. **NOTE** Do not rely on brake release pressure gauge when adjusting relief pressure. Always use a calibrated gauge.
	Damaged brake plunger O-rings.	Replace.
	Low engine RPM.	Adjust to correct low idle RPM.
	Brake Oil Pressure Gauge defective.	Check gauge reading against a calibrated gauge. Replace if gauge is faulty.
	Worn hydraulic pump.	Check pump pressure output only after all the above checks have been made. If pump is at fault, remove and replace.
Oil Brake Not Releasing	Refer to LOW OIL PRESSURE troubleshooting procedure.	
	Accumulator system malfunction.	Check for: a. Damaged or defective accumulators. b. Correct leakdown time as described in Section 4. c. Leak in accumulator lines. d. Leaking accumulator valve.

TABLE 3-1. TROUBLE ANALYSIS CHECK CHART (Sheet 3 of 5)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Oil Brake Not Releasing (Cont'd.)	Damaged brake piston, piston housing or seal rings.	Check piston and piston housing cavity for damage. Replace if scored or broken. Always replace both seals when brake is repaired.
	Setscrews too tight in brake piston plungers causing drag.	Loosen set screws so they can be turned with screw driver from back side.
	Brake release pressure too high.	Add shims to brake cover.
Overheating	Plugged suction filter.	Remove suction filter, clean, and replace. Refer to Section 4.
	Improper cooling oil pressure.	Check cooling oil pressure (refer to Section 4). Replace cooling oil relief valve assembly if required.
	One or both clutches dragging.	Check by placing handlever in Brake-Off Drum will rotate in direction of dragging clutch. Rebuild clutch and replace clutch spring.
	Plugged pressure filter.	Replace.
	Low oil pressure.	Refer to trouble shooting procedure for low oil pressure.
	Control spool travel improperly adjusted	Check and adjust as necessary. Refer to Section 4.
	Excessive inching	When possible, avoid continuous operation in the inching zone.
Low Forward or Reverse Clutch Pressure	Broken seal rings on the bevel gear and brake shaft.	Replace seal rings. **NOTE** A broken seal ring is the most common cause of a pressure differential between the two clutches. Check preload on bevel gear and brake shaft and adjust if necessary to prevent additional breakage of seal rings. Refer to Section 5.
	Damaged bevel gear and brake shaft seal ring grooves.	Check grooves for taper, scoring, and rust. Replace or rebuild shaft if surfaces between the inner side of groove and seal ring are not flat.
	Damaged oil manifold.	Check manifold for grooves, scoring, and rust. Replace retainer if found defective.

TABLE 3-1. TROUBLE ANALYSIS CHECK CHART (Sheet 4 of 5)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Low Forward or Reverse Clutch Pressure (Cont'd).	Loose piston to separator rivets.	Stake or peen rivets tight.
	Cut clutch shaft O-ring	Replace.
	Damaged clutch piston, piston retainer, or O-rings.	Check piston and piston retainer cavity for damage. Replace if scored or broken. Always replace both O-rings when clutch is repaired. Refer to Section 5.
Brake Releases Before Forward Clutch Engagement	Modulator valve in control valve not functioning or out of adjustment.	On early models check forward modulator valve spring. On later models check adjustment as described in Section 4.
	Low brake release pressure.	Remove shims from brake cover.
Brake Releases Before Reverse Clutch Engagement	Modulator valve in control valve not functioning or out of adjustment.	Check adjustment as described in Section 4.
	Low brake release pressure.	Remove shims from brake cover.
Forward or Reverse Oil Clutch Not Engaging (Slipping)	Refer to LOW OIL SUPPLY PRESSURE troubleshooting procedures.	
	Refer to LOW FORWARD OR REVERSE CLUTCH PRESSURE troubleshooting procedures.	
	Inadequate piston travel.	Remove the center access cover and place the winch in gear while visually checking the clutch for piston movement.
	Worn friction discs and separator plates.	Replace the friction discs and separator plates if too thin, scord or distorted. Refer to Section 5.
Forward or Reverse Oil Clutch Not Releasing	Broken or weak release springs.	Check springs and replace as necessary. Refer to Section 5.
	Clutch pack locked up.	Rebuild (see Overheating for symptom)
Winch Will Not Operate While Tracks Are Turning.	Accumulator system malfunction.	Check for: a. Correct leakdown time as described in Section 4. b. Leaking brake accumulator valve. c. Damaged or defective accumulators. d. Leak in accumulator lines.
	Low pump pressure.	Check pump pressure at engine idle. Refer to Section 4.

TABLE 3-1. TROUBLE ANALYSIS CHECK CHART (Sheet 5 of 5)

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
Free-Spool Lever Hard to Shift	Push-pull cable or linkage binding or rusted.	Clean, straighten, repair or replace parts as necessary.
	Shifting collar too tight on splines or splines rough.	Remove shifting collar, dress splines with fine stone, and replace parts if necessary.
	Shifting collar installed backwards.	Install shifting collar so that chamfered ramp will face drum pinion gear. Refer to Section 5.
Jumps Out of Gear Into Free-Spool	Control linkage improperly adjusted.	Check and adjust as necessary.
	Worn shifter fork.	Replace shifter fork and related parts as necessary.
	Worn drum pinion gear bushing.	Replace bushing and related parts as necessary.
	Detent ball and spring loose, damaged, or sticking.	Clean or replace as necessary.
Winch Will not Free-Spool (PFR & PFO)	Linkage improperly adjusted.	Check and adjust as necessary.
	Intermediate shaft assembly damaged, rusted, or preloaded.	Adjust or repair as necessary.
	Drum shaft assembly damaged, rusted, or binding.	Adjust or repair as necessary.
Winch Will not Free-Spool (PFO)	Low oil pressure.	1. Check line to free-spool actuator. 2. Increase engine RPM.
Winch Free-Spools too easily	Insufficient preload on intermediate shaft.	Remove shims as required on the intermediate shaft to preload shaft. Refer to Section 5.
Winch Free-Spools too hard	Too much preload on intermediate shaft.	Add shims as required on the intermediate shaft to reduce the preload on the shaft. Refer to Section 5. **NOTE** It may be necessary to use a slide hammer on the shaft to unload the bearing race because of the fit in the bore.

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SERVICE INSTRUCTIONS

4-1. GENERAL.

4-2. This section contains instructions for performing necessary maintenance and adjustment of control linkage and the hydraulic system. All instructions given in this section may be performed using standard shop tools. No special tools are required.

4-3. MAINTENANCE.

4-4. A planned maintenance program which includes periodic inspection and lubrication should be developed. The operating hours recorded on the tractor SERVICE METER should be used to determine the maintenance level.

4-5. MAINTENANCE AND SERVICE INSPECTION SCHEDULE. (Refer to Table 4-1.)

4-6. The following table is outlined in two schedules: the hourly schedule and the periodic schedule. If the unit is operated more than eight hours per day, the hourly schedule should be followed. If the unit is operated eight hours or less per day, the periodic schedule should be followed.

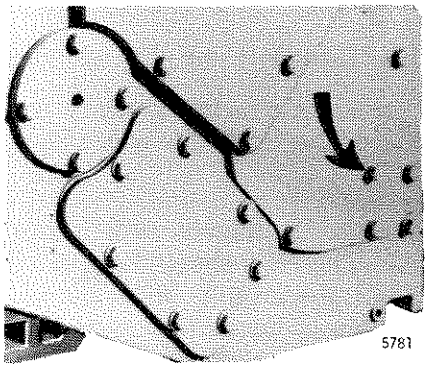
TABLE 4-1. MAINTENANCE AND SERVICE INSPECTION SCHEDULE (Sheet 1 of 2)

REFER TO FIG. NO.	ITEM	SCHEDULE (Hour/Period) 50/ wk	500/ 3 mo	1000/ 6 mo	QUANTITY	TYPE	PROCEDURE
2-1 2-2	Control Lever Assembly	√			Few drops	SAE 30	Lubricate push-pull connections at end of each week.
4-1	Fairlead (Optional)	√				Multi-purpose Grease	Lubricate six grease fittings.
4-1	Oil Level	√		CHANGE	11½ Gals. (45 lts)	DEXRON II or C3 Automatic Transmission Fluid for temperatures above -10°F (-23°C) Conoco DN Type II 600 Hydraulic Oil for temperatures of -10°F (-23°C) and lower.	Check winch oil at level plug Ⓐ on right side of winch. Add oil as required at plug Ⓑ. Drain oil at plug Ⓒ. **NOTE** When checking winch oil level, stop tractor engine to obtain correct reading.
4-1	Breather	√					Wash breather with solvent
5-2	Control Cables	√					Check both ends of each cable housing to see that they are securely anchored. Tighten U-bolt or bracket bolt as applicable. Check winch end of control cable for condition of roll pin anchor.

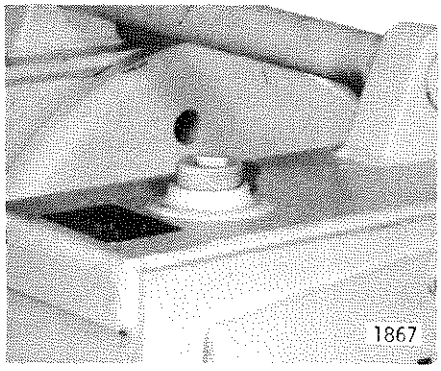
TABLE 4-1. MAINTENANCE AND SERVICE INSPECTION SCHEDULE (Sheet 2 of 2)

REFER TO FIG. NO.	ITEM	SCHEDULE (Hour/Period) 50/ wk	500/ 3 mo	1000/ 6 mo	QUANTITY	TYPE	PROCEDURE
4-1	Suction Filter		SERVICE		One	Magnetic Strainer (Refer to Parts Manual) **NOTE** To prevent loss of oil, tilt the vehicle approximately 15° opposite the suction manifold.	Remove suction filter (E), clean thoroughly, and reinstall. **CAUTION** Suction filter gasket must be in good condition to prevent air leaks. Replace with Hyster-Approved gasket.
4-1	Pressure Filter		CHANGE		One	Paper Element. (Refer to Parts Manual)	Replace with Hyster-Approved filter element (F). Coat filter gasket with a light film of oil to ensure a positive seal.
4-1	Drop Box Oil Level			CHANGE	Fill to required level. * A31 - Sight A32 - Sight C32 - Common Oil Supply C33 - Stick D31 - Stick K31 - Stick R32 - Stick T31 - Common Oil Supply	DEXRON II or C3 Automatic Transmission Fluid for temperatures above -10°F (-23°C) Conoco DN Type II 600 Hydraulic Oil for temperatures of -10°F (-23°C) and lower.	Check oil level at plug, dip stick (G) or sight gauge (H). Add oil as required at fill plug. **NOTE** When checking oil level, stop tractor engine to obtain correct reading.

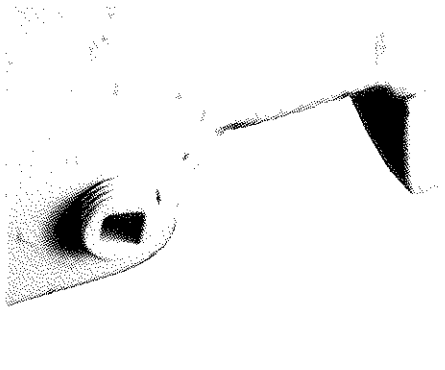
* S/N Suffix See Table 1-5 Page 1-4



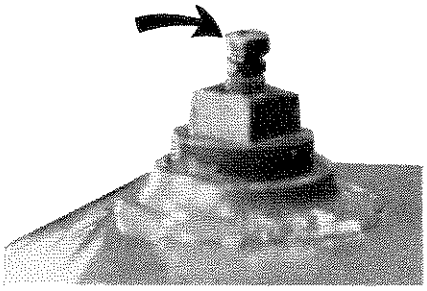
A OIL LEVEL PLUG



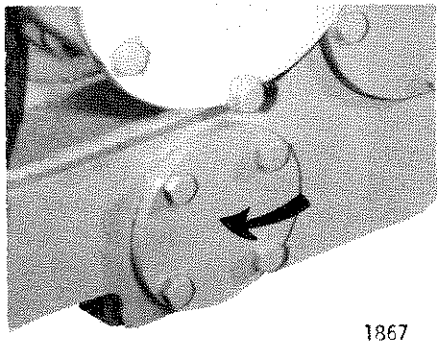
B FILL PLUG



C DRAIN PLUG

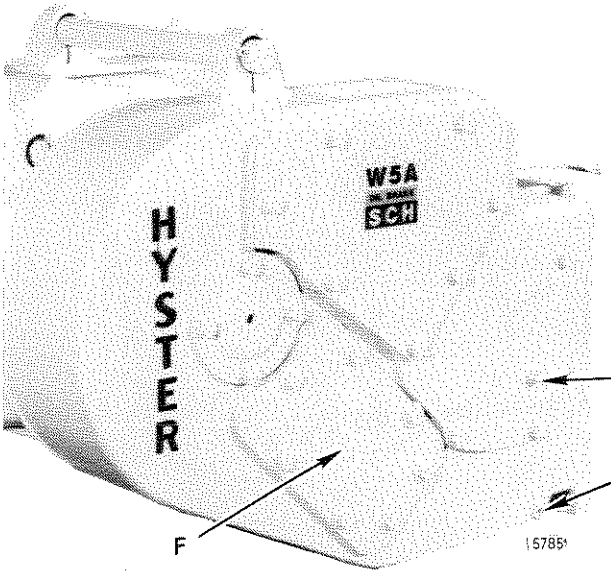


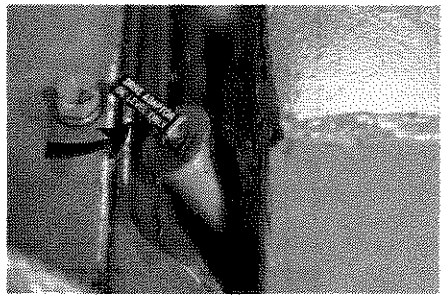
D CASE VENT



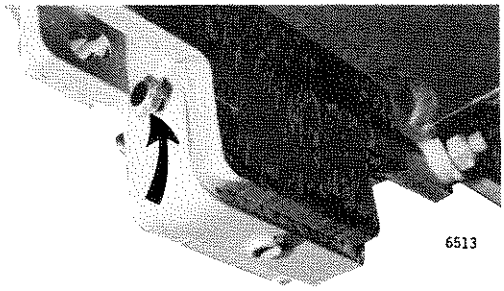
E SUCTION FILTER

F PRESSURE FILTER





G DIP STICK



H SIGHT GAUGE

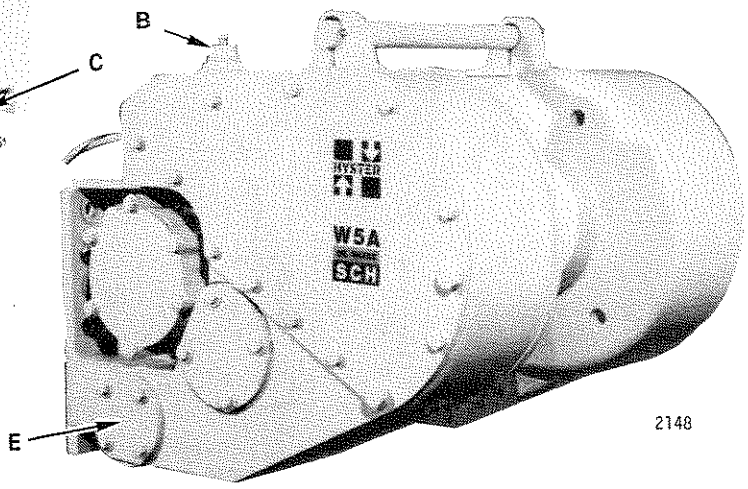


FIGURE 4-1. MAINTENANCE DIAGRAM

CHECKS AND ADJUSTMENTS

4-7. GENERAL.

4-8. The checks and adjustments for the winch include a control cable adjustment, control valve spool travel check and a hydraulic system pressure check. The procedures for the hydraulic system pressure checks include the adjustment of the relief valve, forward modulator valve and reverse modulator valve.

4-9. CONTROL CABLE ADJUSTMENT. (See Figure 4-2).

4-10. A single control cable connects the power lever to the control valve spool. Check operation of power lever to be sure it moves freely and returns smartly to the NEUTRAL position except when in the detented position. Cable adjustment is not necessary except to ensure full spool travel. To adjust, proceed as follows:

1. Ensure that the control lever moves into and holds in the detented position, BRAKE-OFF on PFR winches or FREE-SPOOL on PFO winches.

2. Ensure that the cable bracket at winch end of control cable is securely attached to winch housing.

3. Check position of handlever with control valve in NEUTRAL. The lever should be approximately vertical. If not, loosen nuts on U-bolt that clamp the control cable to the handlever housing. Move U-bolt up or down in elongated slots to improve position of handlever. Tighten nuts securely.

4. On PFR winches move handlever to FORWARD and BRAKE-OFF positions and ensure that the lever holds in the BRAKE-OFF position. On PFO winches move the handlever to FORWARD and FREE-SPOOL positions and ensure that the lever holds in the FREE-SPOOL position. Check to ensure that handlever does not hit housing in either position. If interference is found, repeat step 2.

NOTE See paragraph 4-37 for adjustment of the PFR winch Free-Spool lever.

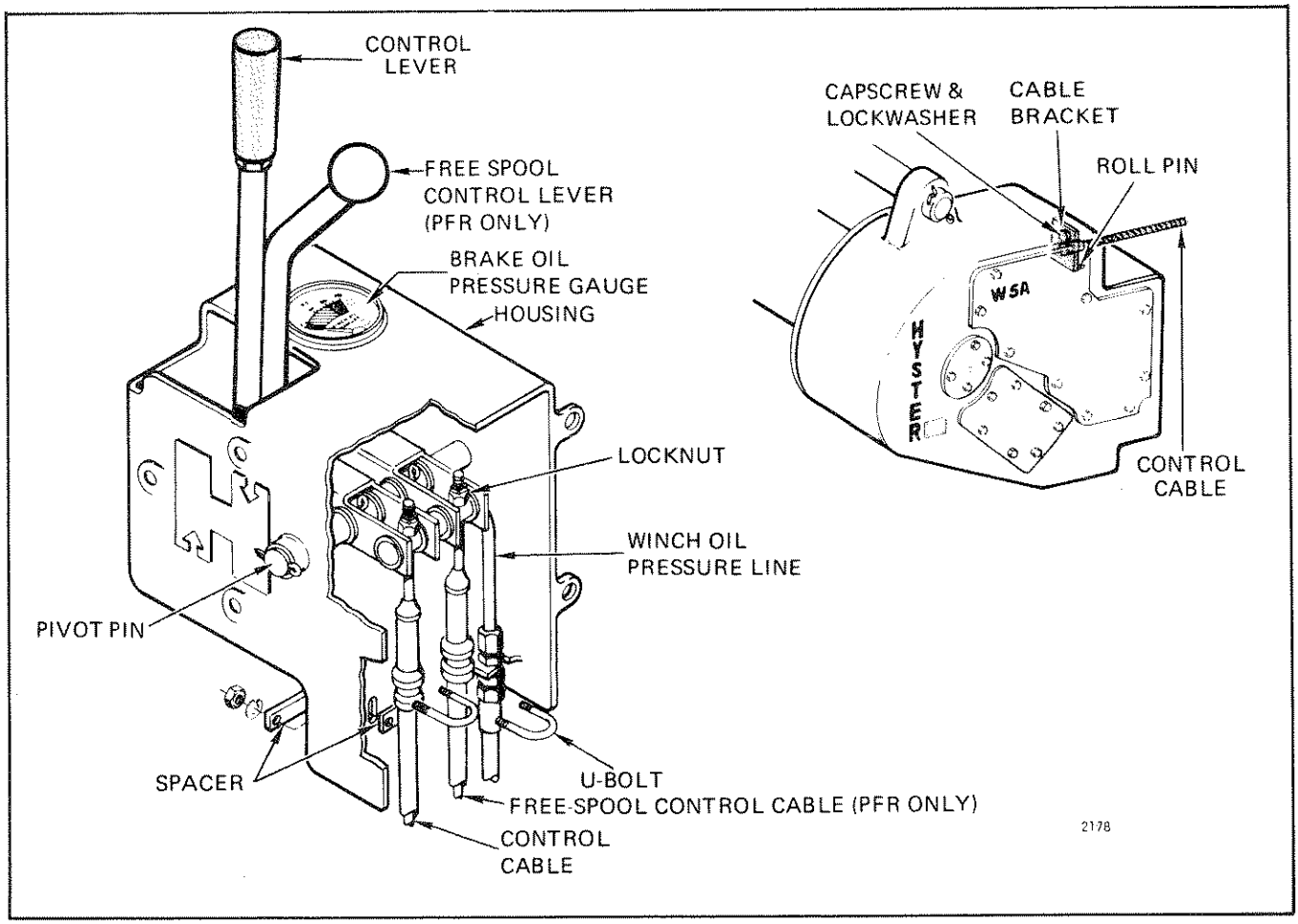


FIGURE 4-2. CONTROL CABLE ADJUSTMENT

4-11. HYDRAULIC SYSTEM PRESSURE CHECKS. – GENERAL

4-12. Prior to checking the hydraulic pressures, perform the following:

1. Remove cable from drum to prevent entanglement during pressure checks.

NOTE For PFR models it is possible to leave the cable on the winch if the drum is left in Free-Spool during the pressure tests.

WARNING Vehicle engine must be shut OFF before disconnecting drum cable. Always wear gloves when handling cable. Be extremely careful when removing the cable lock. The cable may spring away from the drum.

2. Start engine and place the winch in BRAKE-OFF to raise the winch oil to 70°F (20°C) minimum temperature.

3. Remove control valve access plate (see Figure 1-1).

4-13. To perform the hydraulic pressure checks in Table 4-2, calibrated pressure test gauges will be required; two 400 PSI (25 kg/cm²) and one 30 PSI (5 kg/cm²). Refer to Figure 4-3 for test port locations and check the hydraulic pressures as specified in Table 4-2. Observe the following while making hydraulic system pressure checks:

a. Maintain winch oil at 70°F (20°C) minimum.

b. Stabilize engine speed at 1000 RPM for all tests.

NOTE It is recommended that the tractor engine be shut down for connecting and disconnecting test gauges.

CAUTION Control valve lever should be in neutral to avoid accidental discharge of high pressure oil stored in the accumulator.

c. Leave test plugs securely installed unless testing that port.

d. After completing all pressure checks and making the necessary adjustments ensure that all plugs and hoses are securely installed.

e. Install control valve access plate and tighten capscrews to 75 ft.-lbs. (10.37 kg-m) torque.

4-14. Brake Pressure Check and Relief Valve Adjustment.

4-15. To facilitate the test procedures; with the engine shut down connect: (1) one high pressure gauge to the Brake Port Ⓓ with ¼" J.I.C. (37° Flare) female adapter, (2) one high pressure gauge to the Forward Clutch Port Ⓑ, and (3) one low pressure gauge to the Cooling Port Ⓔ . Port Ⓓ must be checked first to ensure that the pump is capable of developing the pressures required for system operation. Start engine and follow the BRAKE procedure in Table 4-2.

4-16. Adequate brake pressure is required to fully release the brake. If the brake pressure is not as specified in Table 4-2, check for: (1) improper relief valve setting or malfunction, (2) hydraulic line leaks (3) suction or pressure filter malfunction (4) pump malfunction.

NOTE A pump malfunction is usually indicated by rapid pressure drop off as the engine speed decreases.

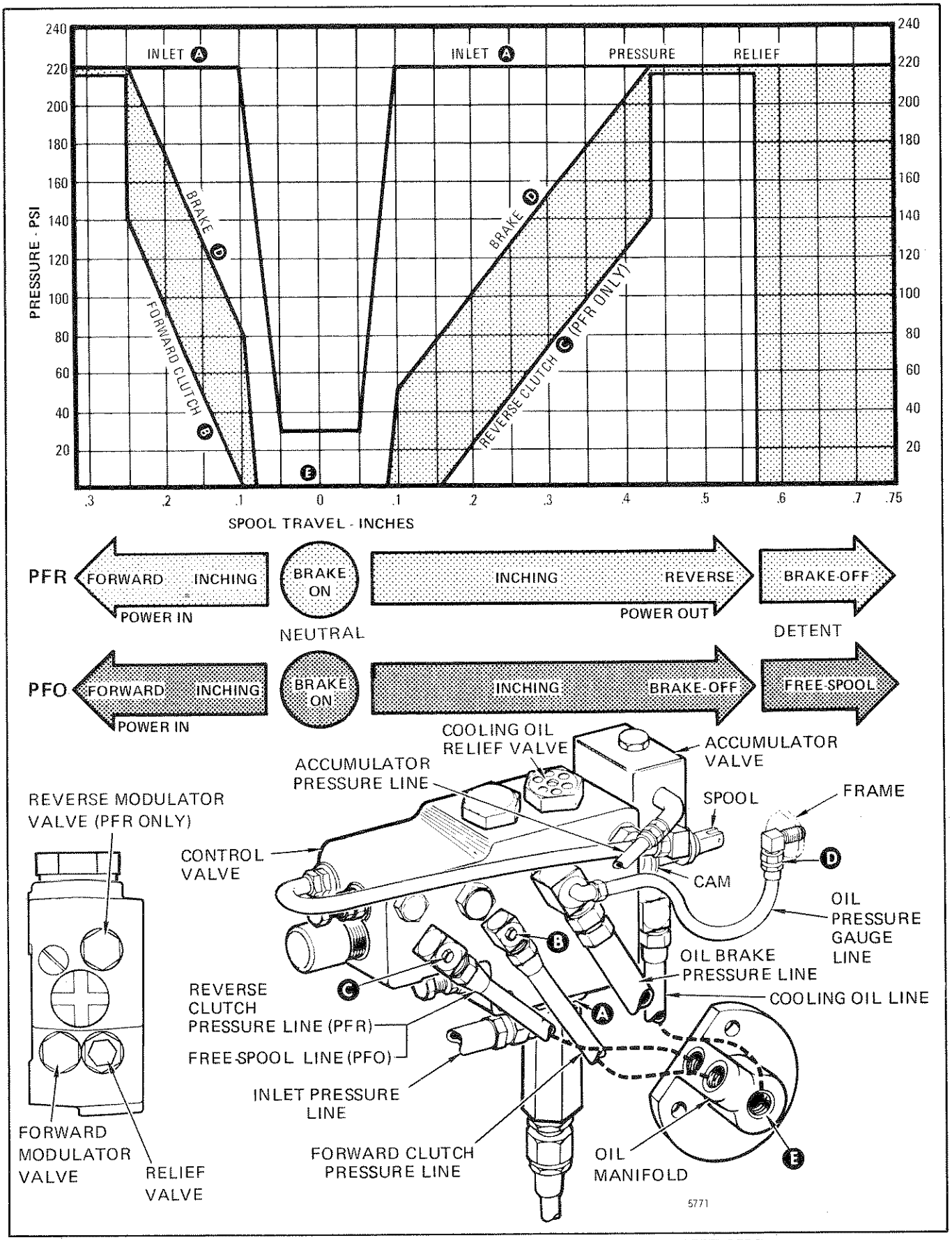


FIGURE 4-3. HYDRAULIC SYSTEM PRESSURE CHECKS

TABLE 4-2. HYDRAULIC SYSTEM PRESSURE TESTS (Sheet 1 of 2)
NOTE Engine @ 1000 RPM and Oil Temperature @ 70°F (20°C) minimum.

SYSTEM FUNCTION	CHECK PORT	CONTROL POSITION	PRESSURE	CORRECTIVE ACTION
BRAKE	Ⓓ-BRAKE 1-400 PSI (25 kg/cm²) gauge required	BRAKE-OFF	220 ± 5 PSI (15.5 ± 0.35 kg/cm²) Low idle - 200 PSI Minimum (14 Kg/cm²) High idle - 250 PSI Maximum (17.6 Kg/cm²)	Adjust relief valve as described in paragraph 4-17. Refer to paragraph 4-16.
COOLING	Ⓔ-COOLING 1-30 PSI (5 kg/cm²) gauge required	NEUTRAL	6-9 PSI (0.42 - 0.63 kg/cm²) Low idle - 4 PSI Minimum (0.28 Kg/cm²) High idle - 10 PSI Maximum (0.70 Kg/cm²)	Adjust pressure. Refer to Par. 4-18. Check cap per figure 1-9. Replace cooling oil relief valve if required.
ACCUMULATOR	Ⓓ-BRAKE 1-400 PSI (25 kg/cm²) gauge required.	1. BRAKE-OFF 2. NEUTRAL 3. STOP ENGINE 4. BRAKE-OFF	220 ± 5 PSI (15.5 ± 0.35 kg/cm²) NONE NONE-wait one minute 150 PSI (10.5 kg/cm²) immediately and 100 PSI (7.0 kg/cm²) minimum after 15 seconds	Refer to paragraph 4-34.
FORWARD	Ⓑ-FORWARD 1-400 PSI (25 kg/cm²) gauge required.	FORWARD	220 ± 5 PSI (15.5 ± 0.35 kg/cm²)	Refer to Table 3-1 LOW FORWARD OR REVERSE CLUTCH PRESSURE troubleshooting procedure.
FORWARD INCHING	Ⓑ-FORWARD Ⓓ-BRAKE 2-400 PSI (25 kg/cm²) gauges required.	Vary between NEUTRAL and FORWARD	Port Ⓑ 80 PSI (5.6 kg/cm²) less than Port Ⓓ Reduce pressure for heavy loads. Minimum - 40 PSI (2.8 Kg/cm²)	Adjust forward modulator as described in paragraph 4-27.
REVERSE (PFR ONLY)	Ⓒ-REVERSE 1-400 PSI (25 kg/cm²) gauge required.	REVERSE	220 ± 5 PSI (15.5 ± 0.35 kg/cm²)	Refer to Table 3-1 LOW FORWARD OR REVERSE CLUTCH PRESSURE troubleshooting procedure.
REVERSE INCHING (PFR ONLY)	Ⓒ-REVERSE Ⓓ-BRAKE 2-400 PSI (25 kg/cm²) gauges required.	BRAKE INCHING	Port Ⓒ 80 PSI (5.6 kg/cm²) less than Port Ⓓ	Adjust reverse modulator as described in paragraph 4-30.
FREE-SPOOL (PFO ONLY)	Ⓒ-REVERSE 1-400 PSI (25 kg/cm²) gauge required.	FREE-SPOOL	220 ± 5 PSI (15.5 ± 0.35 kg/cm²)	Check free-spool actuator for proper operation. Inspect hoses and O-ring seals.

4-17. To adjust the relief valve:

a. Loosen relief valve locknut.

b. Turn relief valve adjusting capscrew IN to increase pressure or OUT to decrease pressure.

c. Tighten locknut after adjustment is completed.

d. Recheck pressure reading and repeat steps a through c if necessary.

4-18. Cooling Oil Pressure Check.

4-19. With engine still running follow the cooling oil procedure in Table 4-2. If the cooling oil pressure is too high, it can create a back pressure in the system and result in overheating. The cooling oil pressure can be increased by screwing the cooling oil relief valve cap in. The cap should be approximately flush as shown in Figure 1-9. It is secured in place with stud lock.

4-20. Accumulator Pressure Check.

4-21. This check determines if the accumulators are functioning and have the correct nitrogen charge. Also by waiting one minute the placing the winch in Brake-Off, this check tells if the accumulator valve is holding the pressure. With engine still running, follow the accumulator procedures in Table 4-2.

4-22. If the accumulators do not hold pressure as specified in Table 4-2, check for: (1) leaking pressure hoses or fittings, (2) defective accumulator valve, or (3) defective accumulator(s). Troubleshooting information is given in Table 3-1. If defective accumulators are suspected, see paragraph 4-34 for testing volume and nitrogen charge.

4-23. Forward Clutch Pressure Check and Forward Modulator Valve Adjustment.

4-24. Start the engine to check FORWARD clutch and FORWARD INCHING pressures as indicated in Table 4-2. On a fast shift the clutch pressure should come up with the brake pressure. In forward inching the clutch pressure should lag the brake release pressure as shown in Table 4-2. If the pressure differential is too low the brake will not release soon enough and cause drag. If the pressure differential is too high the brake will release too soon and cause inadvertent dropping of the load.

4-25. If the forward clutch pressure is not as specified in Table 4-2, check for: (1) leaking pressure hoses or fittings, (2) damaged or worn clutch piston seals, (3) improper control valve spool movement, (4) broken seal rings on bevel gear and brake shaft, or (5) a damaged oil manifold. Troubleshooting information is given in Table 3-1.

4-26. If in forward inching, the pressure differential is not as specified in Table 4-2 and the winch has an adjustable modulator valve (see Figure 4-3), proceed as follows:

a. Loosen the forward modulator adjustment locknut. Move the handlever toward forward until the brake pressure reads 140 PSI (9.8 kg/cm^2).

b. Turn the adjusting capscrew IN to decrease Forward Clutch Pressure (B), or OUT to increase pressure. Set the forward clutch pressure to be 80 PSI (5.6 kg/cm^2) less than the brake pressure. Heavier loads may require a lower pressure differential.

c. Tighten locknut and recheck pressure. Repeat steps a and b if necessary.

4-27. Reverse Clutch Pressure Check and Reverse Modulator Valve Adjustment. (PFR Winches Only.)

4-28. Shut the engine down and remove the high pressure gauge from Forward Clutch Port (B) and connect it to the Reverse Clutch Port (C). Start the engine to check reverse clutch and reverse inching pressures. On a fast shift the clutch pressure should come up with the brake pressure. In reverse inching the clutch pressure should lag the brake release pressure as shown in Table 4-2. If the pressure differential is too low the brake will not release soon enough and cause drag. If the pressure differential is too high the brake will release too soon and cause inadvertent dropping of the load.

4-29. If the reverse clutch pressure is not as specified in Table 4-2, check for: (1) leaking pressure hoses or fittings, (2) damaged or worn clutch piston seals, (3) improper control valve spool movement, (4) broken seal rings on bevel gear and brake shaft, or (5) a damaged oil manifold. Toubleshooting information is given in Table 3-1.

4-30. If in reverse inching the pressure differential is not as specified in Table 4-2 proceed as follows:

a. Loosen the reverse modulator adjustment locknut. Move the handlever towards reverse until the brake pressure reads 140 PSI (9.8 kg/cm^2).

b. Turn the adjusting capscrew IN to decrease Reverse Clutch Pressure Ⓒ, or OUT to increase pressure. Set the Reverse Clutch Pressure to be 80 PSI (5.6 kg/cm²) less than the brake pressure.

c. Tighten locknut and recheck pressure. Repeat steps a and b if necessary.

4-31. Free-Spool Pressure Check. (PFO Winches Only.)

4-32. Shut the engine down and remove the high pressure gauge from Forward Clutch Port Ⓑ and connect it to Port Ⓒ. See Figure 4-3.

4-33. Install gauge as described in paragraph 4-28. Start the engine to check the free-spool pressure as shown in Table 4-2. This check will determine if adequate pressure is available to operate the free-spool actuator. If the pressure is too low, check for: (1) leaking pressure hose or fitting, or (2) a defective piston seal in the hydraulic actuator.

4-34. ACCUMULATOR VOLUME TEST

NOTE The accumulator valve must be in good working order to make this test.

4-35. The volume of oil in the accumulators indicate their condition and the condition of the accumulator valve seat. Lower volume will indicate high accumulator charge pressure. Half volume will indicate probable failure of one accumulator. High volume will indicate low accumulator charge pressure. Refer to Table 4-2. No volume will indicate zero charge pressure or both accumulators have failed. To test the volume proceed as follows:

1. Start engine and place control lever in brake off and increase engine RPM so brake pressure is 220 PSI (15.5 kg/cm²) for 1 minute. Return lever to neutral.

2. Shut off engine.

3. Disconnect and plug ¼-inch tube (from accumulator valve to the brake).

4. Disconnect ¼-inch hose to pressure gauge and hold in quart can – cover to prevent splash.

5. Place handlever in brake off to activate valve spool and accumulator charge valve.

6. Measure oil quantity at 7 oz. (0.21 lts) per accumulator or 14 oz. (0.41 lts) total. If less remove valve stem cover and gently press stem. Leaky bladder will emit oil.

7. Replace accumulators or have nitrogen charge replenished as required.

NOTE The accumulators are to have a nitrogen charge of 100 PSI (7.0 kg/cm²). A special fitting should be used in the charge port to reduce the bore size down to accept a 150 PSI (10.5 kg/cm²) tire gauge. This fitting is generally available at locations that have charging equipment for accumulators.

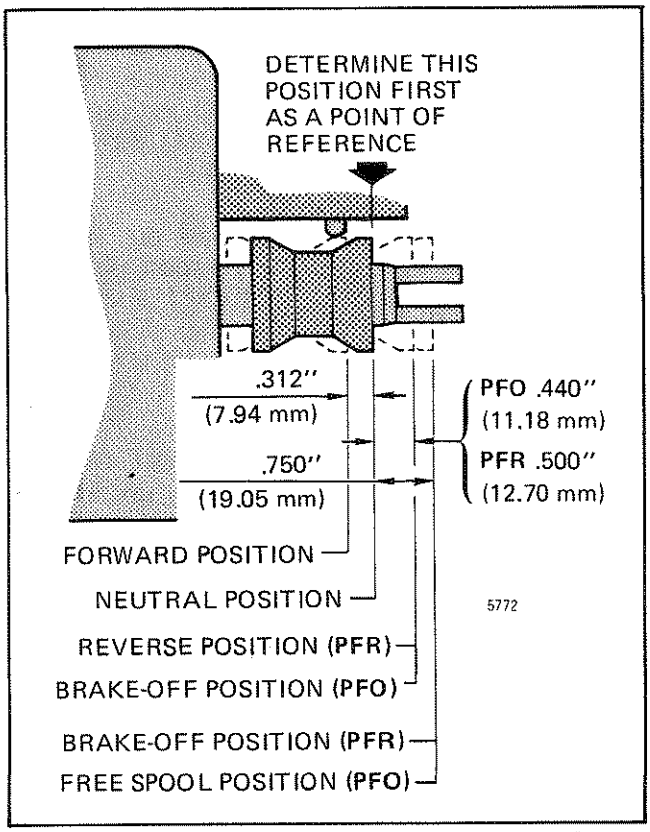


FIGURE 4-4. CONTROL VALVE SPOOL TRAVEL CHECK

4-36. CONTROL VALVE SPOOL TRAVEL CHECK. (See Figure 4-4).

4-37. It may be necessary to check spool travel when pressure checks do not meet specification. Figure 4-4 shows the correct travel for the various spool positions and the related hydraulic pressures. The control valve spool is self-positioned to NEUTRAL. The three other travel positions are determined by spool assembly internal stops and detent. If spool travel is found to be out of adjustment, the spool assembly or complete control valve assembly should be replaced. Ensure that the spool cap is installed securely. Perform the spool travel check as follows:

1. Check handlever to ensure that the full travel is unrestricted.

2. Using a small ruler, determine the Neutral position of spool as shown in Figure 4-4. In this position the spool end should protrude approximately 15/16-inch (23.8 mm) from the valve body.

3. Move spool into body until it bottoms. This position is FORWARD and should be at 5/16-inch (7.9 mm) travel from NEUTRAL as shown in Figure 4-4.

4. Move spool out of body until the first stop is felt. On PFR winches this position is REVERSE and BRAKE INCHING on PFO winches. This stop should be at ½-inch (12.7 mm) travel from NEUTRAL as shown in Figure 4-4.

5. Move spool out of body, past the stop felt in step 4, into the detented position. On PFR winches this position is BRAKE-OFF and FREE-SPOOL on PFO winches. This stop should be at 3/4-inch (19.1 mm) travel from NEUTRAL as shown in Figure 4-4.

NOTE Spool is detented in BRAKE-OFF or FREE-SPOOL. If spool does not lock up in this position, examine the detent parts inside the spool cap and repair or replace as required.

6. Push the spool out of detent and allow spool to return to NEUTRAL.

4-38. FREE-SPOOL LEVER ADJUSTMENTS. (PFR ONLY)

NOTE PFO winches do not have a separate lever for Free-Spool operation.

4-39. The only adjustment necessary is to position the handlever so that it allows the linkage to shift the free spool mechanism to power and free-spool positions (both positions detented).

4-40. Free spool drag adjustment.

4-41. Adjust preload on intermediate shaft tapered roller bearings by varying shims. See Figure 5-13.

4-42. DECAL, NAMEPLATE AND SERVICE PLATE INSTALLATION.

4-43. The unit nameplate, a Warning Decal, Caution Decal and a Filter Service Plate are located on the winch as shown in Figure 4-5. If the nameplate has been damaged, obtain a new one and install the new nameplate in the location shown in Figure 1-1. If the Warning Decal, Caution Decal or Filter Service Plate have been damaged, obtain a new one and install in the location shown in Figure 4-5.

4-44. The W5A model decals and HYSTER letter decals are used on both sides of the winch frame as shown in Figure 4-5. Replace as necessary.

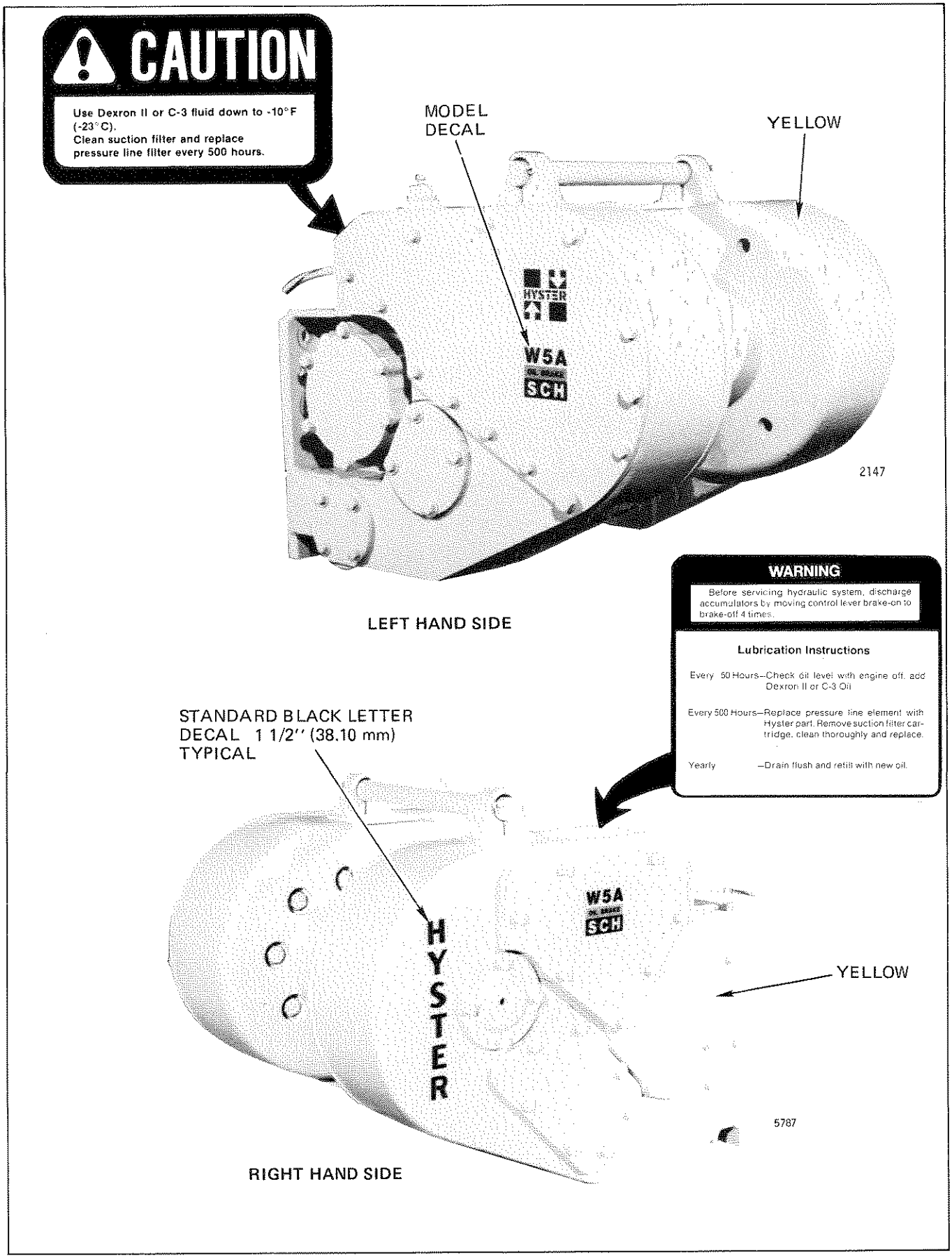


FIGURE 4-5. PAINTING AND DECAL INSTALLATION

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OVERHAUL INSTRUCTIONS

5-1. GENERAL.

5-2. This section contains overhaul instructions for the Power Controlled Winches. Overhaul instructions include removal and disassembly of all major shaft assemblies, inspection of components, reassembly and installation.

Micrometer symbols have been added to the disassembly illustrations to indicate critical wear points. It is recommended that these points be inspected as described in Table 5-1, at the time of disassembly so that defective parts may be ordered and replaced prior to reassembly. If the winch is to be completely overhauled, perform the removal and disassembly, inspection and reassembly procedures in the sequence of the following paragraphs. Always use the troubleshooting procedures given in Section 3 to locate a malfunction before performing major overhaul of the unit. Make all checks in a systematic manner. Haphazard checking wastes time and can cause further damage. Review and perform any adjustments that may be the cause of a malfunction (refer to Section 4).

5-3. This section includes instructions for removal and installation of the winch for repairs. Initial installation procedures and controls of the winch are given in a separate Mounting Instructions Manual.

5-4. WINCH REMOVAL. (See Figure 5-1.)

5-5. Prior to disassembly of the winch, the cable must be removed from the drum and drain oil.

WARNING • Use extreme care when removing the cable end ferrule from the drum. When the cable is removed, the cable may spring out with extreme force.

• Discharge oil from accumulators to prevent accidental discharge of stored high pressure oil by moving the handlever to the BRAKE-OFF POSITION several times until all pressure is relieved.

5-6. Remove the winch as shown in Figure 5-1. Observe the following during removal:

a. Clean external surfaces of winch to remove accumulated grease and dirt.

b. Remove transmission cover and control valve cover.

c. When removing covers tap periphery of cover with hammer to loosen gasket.

d. Disconnect control cables from handlevers and pressure gauge line from winch.

e. Attach lifting device as shown in Figure 5-1.

WARNING Make sure that the lifting device has a minimum capacity of 3,000 pounds (1360 kg) before lifting the winch off the mounting pads.

f. Remove nuts from mounting studs.

g. Remove winch from vehicle.

5-7. COMPONENT REMOVAL AND DISASSEMBLY.

5-8. On most vehicles major assemblies except the PTO shaft can be removed with the winch mounted on the vehicle. The sequence of operations given in this section is for a complete unit overhaul, but is not necessary for removal of individual shaft assemblies.

5-9. Removal and Disassembly of PTO Shaft Assembly.

5-10. Removal and disassembly of the PTO shaft is shown in Figure 5-2. Before removing the PTO shaft assembly, the winch must be removed from the vehicle as shown in Figure 5-1.

5-11. Removal and Disassembly of Oil Brake Assembly.

5-12. Removal and disassembly of the oil brake assembly used in the winch is shown in Figure 5-3. Removal and disassembly of the brake can be accomplished while the winch is mounted on the vehicle. During disassembly, place all parts in a clean container to protect from dust, dirt and moisture. Inspect all parts for damage and wear as specified in Table 5-1.

5-13. Removal and Disassembly of Bevel Gear and Brake Shaft Assembly. (See Figures 5-4 and 5-5.)

5-14. Removal and disassembly of the bevel gear and brake shaft assembly is shown in Figure 4-5. Removal of the bevel gear and brake shaft and associated components can usually be accomplished with the winch mounted on the vehicle. Prior to removal of the bevel gear and brake shaft, perform the following:

a. Drain oil from winch (see Figure 4-1).

b. Remove all brake components as shown in Figure 5-3.

c. Remove the hydraulic lines from the oil manifold at the RH end of the bevel gear and brake shaft.

5-15. Disassembly of Oil Clutch Assembly.

5-16. Disassembly of the oil clutch is shown in Figure 5-6. Removal of the clutch assembly is shown in Figure 5-5.

5-17. Removal of Drum and Drum Shaft.

5-18. Removal of the drum and drum shaft is shown in Figure 5-8 (see Figure 5-7 for component location). Do not attempt to remove heavy components (such as the drum) by hand. Use lifting devices whenever possible.

5-19. Removal of Intermediate Shaft and Drum Gear Assembly.

5-20. Removal of the intermediate shaft and associated components is shown in Figure 5-9. The intermediate shaft can be removed with the winch mounted on the vehicle. Prior to removal of the drum gear, sufficient clearance must be obtained by removing the intermediate shaft and free-spool shifter.

NOTE Figure 5-8 shows the winch removed from the vehicle with the bevel gear and brake shaft removed. This is the normal sequence for complete unit overhaul but is not necessary for removal of the intermediate shaft only.

5-21. Removal of Control Valve. (See Figure 5-10.)

5-22. Access to the control valve may be obtained by removing the control valve access cover plate on the right-hand side of winch housing. Remove the control valve as follows (see Figure 5-10):

WARNING Discharge oil from accumulators to prevent accidental discharge of stored high pressure oil by moving the hand-lever to the BRAKE-OFF position several times until all pressure is relieved.

a. Detach the control cable from the valve spool clevis (see Figure 5-1).

b. Disconnect the inlet pressure line, brake pressure line, brake pressure gauge line, cooling oil line, forward and reverse clutch pressure lines on PFR units, or forward clutch pressure line and free-spool actuator line on PFO units, at their respective valve port fittings. Rotate tube fittings in valve to clear the tube ends. (Leave tube(s) attached to manifold).

c. Remove the three capscrews and lockwashers and remove control valve with attached accumulator control valve.

NOTE Refer to Section 4 for control valve repairs.

5-23. Removal of Hydraulic Pump.

5-24. Removal of the hydraulic pump is shown in Figure 5-11. Removal can be accomplished with the winch mounted on the vehicle. Access to the hydraulic pump can be obtained by removing the top and right-hand access covers.

5-25. CLEANING.

5-26. When parts are removed from the winch, remove accumulated grease and dirt using mineral spirits or other suitable cleaning solvents. Never inspect parts coated with excessive amounts of grease or dirt. Damage to a part may not be obvious unless thoroughly cleaned. Steam clean all external surfaces of the winch prior to reassembly.

5-27. BEVEL GEAR AND BRAKE SHAFT OIL PASSAGES. Ensure that the oil passages in the bevel gear and brake shaft are clean. To aid in cleaning the passages, remove the plugs from the outboard holes. Blow air through passageways.

5-28. VISUAL INSPECTION.

5-29. Table 5-1 contains procedures for visual inspection of all critical parts of the winch assembly.

5-30. MINOR REPAIRS.

5-31. Control Valve Repairs.

5-32. Repair of the control valve is limited to removal and replacement of individual components as shown in Figure 5-10. Replace components as required, if found to be defective or not meeting the specifications listed in Table 1-1. The following procedures should be observed:

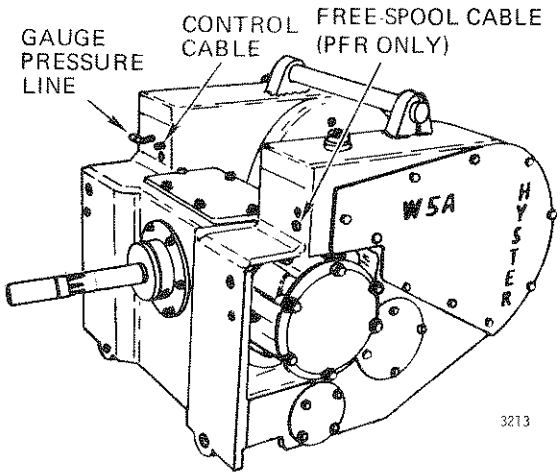
CAUTION Do not attempt to machine any part of the control valve. If parts are found to be defective, replace the part. Do not hone the valve spool bores.

a. Discard all old O-rings. Lubricate all new O-rings with hydraulic oil before installation.

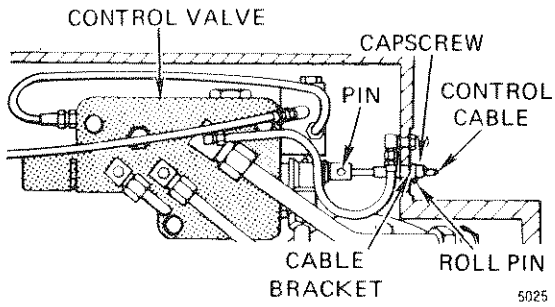
b. Check all threads in the valve body and on external fittings. If threads in the valve body have been damaged, rethread using same size tap. Make sure that all contaminants are removed from the valve ports.

c. Check all springs for weak or collapsed coils.

NOTE Prior to removal, perform the procedures in paragraph 5-5.

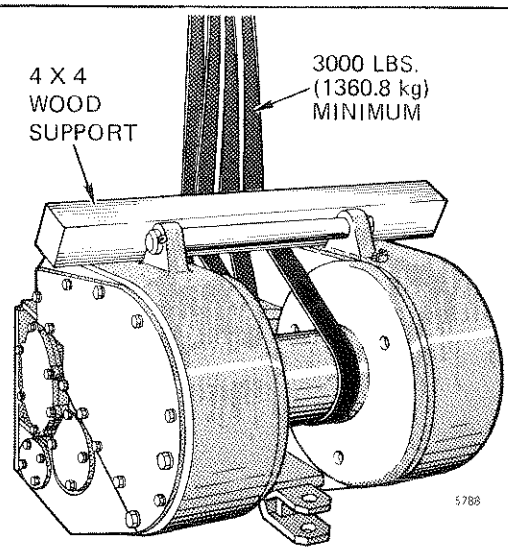


STEP 1. Disconnect gauge pressure line, control cable and free-spool cable if so equipped.



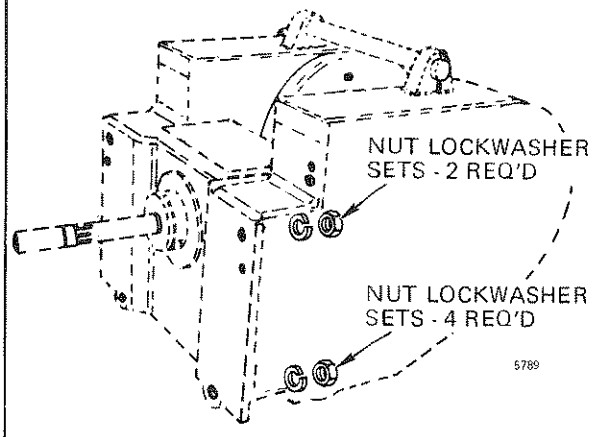
STEP 2. Remove control valve access cover plate. Remove cotter pin and detach blade end of control cable from control valve spool clevis. Remove capscrew holding cable bracket to housing, and pull out control cable. If necessary to remove cable bracket, remove roll pin.

WARNING Discharge oil from accumulators to prevent accidental discharge of stored high pressure oil by moving the handlever to the BRAKE-OFF position and hold until all pressure is relieved.



STEP 3. Attach lifting device to winch. Winch will be balanced when connected as shown.

NOTE Mounting studs are not shown.



STEP 4. Remove the mounting nuts (or capscrews) and lockwashers securing the winch to the vehicle.

NOTE When removing the mounting nuts (or capscrews) loosen all nuts slightly, then pry winch away from mounting pad. Loosen all nuts again. Continue this sequence until winch can be removed.

FIGURE 5-1. REMOVAL OF WINCH.

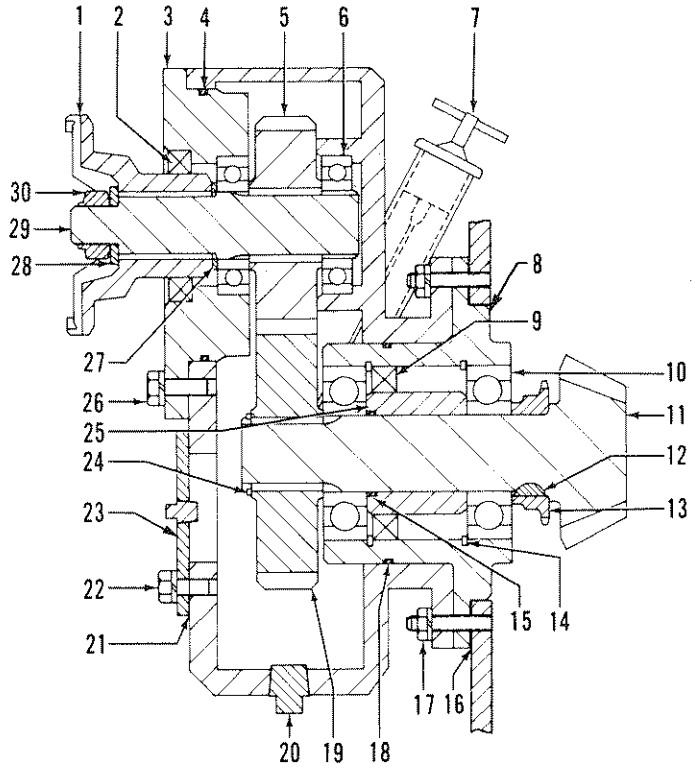
- Drain the oil from the winch and gearbox. Remove them from the tractor. Remove the large right hand side cover off the winch and disconnect the pump drive chain. Remove the nuts item 17, and pull the gearbox out of the winch case.

- Remove dipstick item 7. Remove capscrews item 22, cover item 23, and gasket item 21. Reach into opening and remove snapring, item 24. Insert screwdrivers between bearing carrier item 8 and gearbox to remove bearing carrier item 8. Gear item 19 will remain inside the gearbox.

- Discard o-ring item 18. Remove pinion item 11 from bearings item 10. Remove bearings item 10 from retainer item 8. Remove snapring item 14 and seal item 9. Discard o-ring item 15.

- Remove capscrews item 26. Install two of the capscrews into the threaded pusher holes. Pull carrier item 3 from the gearbox. Discard o-ring item 3.

- Remove the rear bearing item 6 from the shaft item 29. Remove gear item 5. Clamp the splined end in soft vise jaws and remove nut item 30 and washer item 28. Pull yoke item 1 off the shaft. Slide carrier item 3 off the shaft. Discard o-ring item 4 and seal item 2. Replace bearing item 6. Clean all parts.



1. Yoke
2. Seal
3. Carrier
4. O-ring
5. Gear
6. Bearing
7. Dipstick
8. Bearing Carrier
9. Seal
10. Bearing
11. Pinion Shaft
12. Woodruff Key
13. Drive Sprocket
14. Snapring
15. O-ring
16. Shim Pack
17. Nut
18. O-ring
19. Gear
20. Drain Plug
21. Gasket
22. Capscrew
23. Cover
24. Snapring
25. Seal Sleeve
26. Capscrew
27. Spacer
28. Washer
29. Shaft
30. Nut

FIGURE 5-2. DISASSEMBLY OF PTO ASSEMBLY FOR D45 KOMATSU (Sheet 1 of 4)

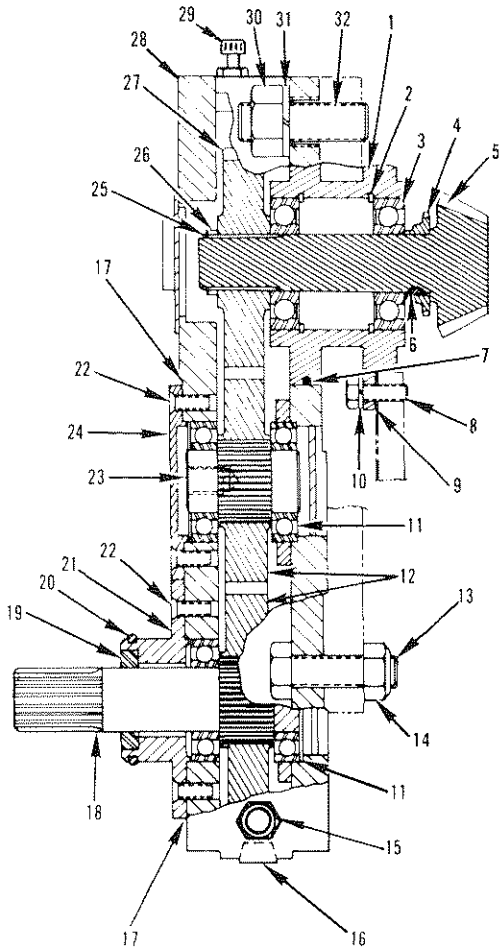
- Drain the oil from the winch and gearbox. Remove the winch from the tractor. Remove the large right hand cover off the winch and disconnect the pump drive chain. Remove nuts item 30, and then pull the gear box straight off bearing carrier item 1.

- Remove the capscrews item 8 clamping item 1 against the winch case. Pull the carrier out of the winch case bore. Remove snapring item 25, spacer item 26, and gear item 27. Remove shaft item 5 from bearing item 3, Remove bearings item 3 from retainer item 1. Discard o-ring item 7.

- Remove cover item 24 and gasket item 17. Install a slide hammer puller into shaft item 23 and pull the shaft out of the case. Remove bearings item 11 from the shaft and gearbox.

- Discard o-ring item 20. Remove cover item 21, and discard gasket item 17. Remove the seal item 19 from the cover item 21.

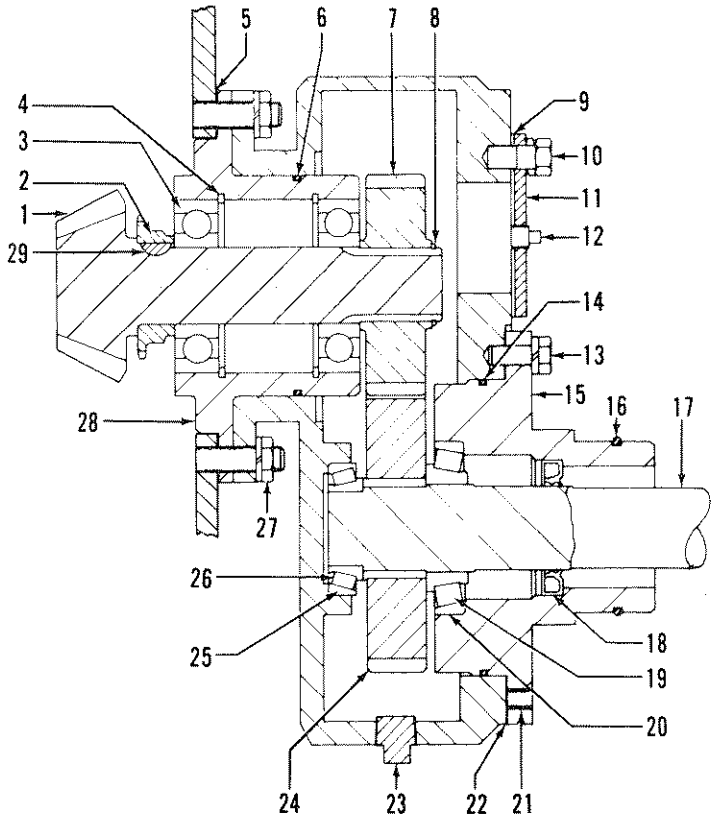
- Insert a bar through the lock pin hole in the PTO shaft item 18. Hit the bar with a hammer to remove the shaft from the case. Remove the rear bearing item 11, and gear item 12. Remove the front bearing item 11 from the PTO shaft. Clean all components.



1. Retainer
2. Snapring
3. Bearing Sealed
4. Drive Sprocket
5. Pinion Shaft
6. Woodruff Key
7. O-ring
8. Capscrew
9. Shims
10. Lockwasher
11. Bearing
12. Gear
13. Capscrew
14. Nut
15. Sightglass
16. Drain Plug
17. Gasket
18. PTO Shaft
19. Seal
20. O-ring
21. Retainer
22. Capscrew
23. Shaft
24. Cover
25 Snapring
26. Spacer
27. Gear
28. Gearbox
29. Breather
30. Nut
31. Lockwasher
32. Stud

FIGURE 5-2. DISASSEMBLY OF PTO ASSEMBLY FOR FIAT 8, FL9, AND 10 (Sheet 2 of 4)

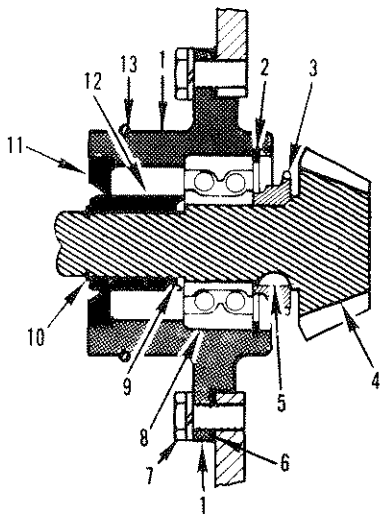
- Drain the winch oil level down below the large right side cover. Remove the large right side cover. Disconnect and remove the pump drive chain.
- Drain the oil from the gearbox by removing plug item 23. Disconnect the hydraulic hose from the gear box.
- Remove the nuts item 27 and pull the gearbox out of the winch.
- Remove capscrews item 13. Install two of them into holes item 21. Grasp PTO item 17 and pull. The assembly will come out.
- Remove bearing cone item 26, gear item 24 and cone item 19.
- Remove bearing cup item 20, seal item 18, and O-ring item 16 from retainer item 5.
- Remove capscrews item 10 and cover item 11. Remove snapring item 8. Hit the end of shaft item 1. Hit the edge of carrier item 28 if it hasn't come out already.
- Remove O-ring item 6 from carrier item 28.
- Remove the two bearings item 3 and snaprings item 4.
- Remove gear item 7 from the case.
- Remove bearing cup item 25 from the case.



1. Pinion Shaft
2. Drive Sprocket
3. Bearing
4. Snapring
5. Shim
6. O-ring
7. Gear
8. Snapring
9. Gasket
10. Capscrew
11. Cover
12. Plug
13. Capscrew
14. O-ring
15. Retainer
16. O-ring
17. PTO Shaft
18. Seal
19. Bearing Cone
20. Bearing Cup
21. Threaded Hole
22. Shim Pack
23. Drain Plug
24. Gear
25. Bearing Cup
26. Bearing Cone
27. Capscrew
28. Carrier
29. Woodruff Key

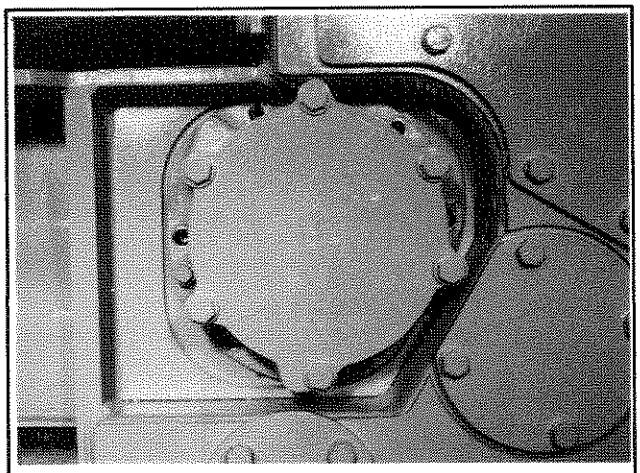
FIGURE 5-2. DISASSEMBLY OF PTO ASSEMBLY FOR CAT D4 (Sheet 3 of 4)

- Remove capscrews item 7. Pull PTO shaft and assembly out of winch case.
- Remove snapring item 10. Lift carrier item 1 with both hands, and rest the coupling end of shaft item 4 on a block of wood. Lift the shaft above the block of wood and drop the shaft downward against the block of wood. The carrier will slide down the shaft. Remove items 12 and 9.
- Remove snapring item 2 from carrier item 1.
- Remove bearing item 8 and seal item 11 from carrier item 1.
- Inspect sprocket item 3 for gear tooth wear.



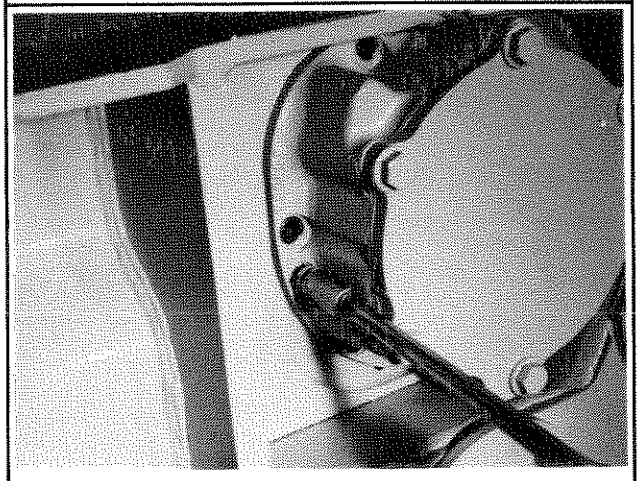
1. Bearing carrier
2. Snapring
3. Drive sprocket
4. Pionin shaft
5. Woodruff key
6. Sim pack
7. Capscrews
8. Bearing
9. O-ring
10. Snapring
11. Seal
12. Seal sleeve
13. O-ring

FIGURE 5-2. DISASSEMBLY OF PTO ASSEMBLY FOR CAT D3, HD6, AND MF D400C (Sheet 4 of 4)

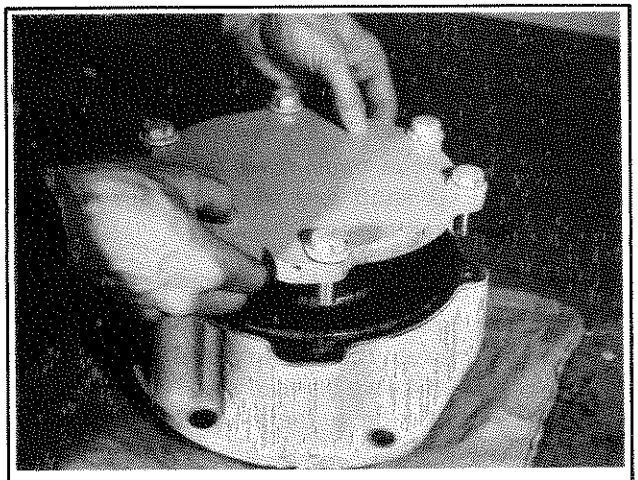


BRAKE DISASSEMBLY

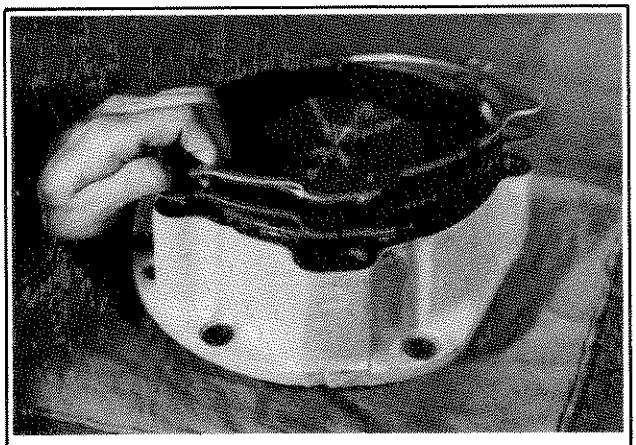
STEP 1. Use a 1/2 inch 12 point socket to loosen the outer capscrews. If the oil brake is to be disassembled, loosen the six 1/2-inch capscrews on the cover. Do not remove the six capscrews from the cover. NOTE: The cover is under spring tension and cover capscrews must be loosened evenly.



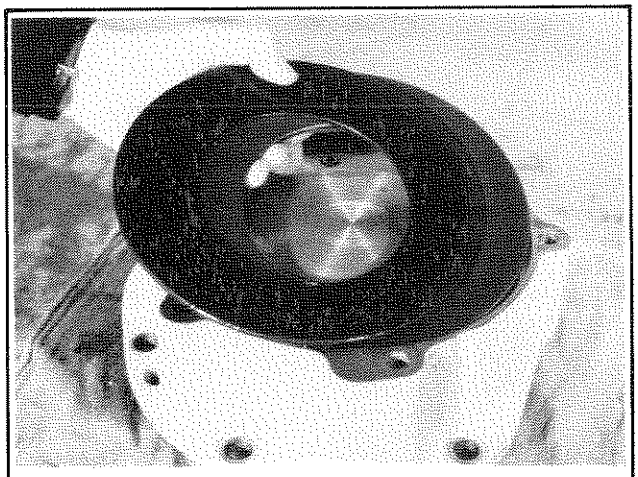
STEP 2. Install two of the capscrews into the threaded holes. Tighten evenly until the brake housing is loose. Pull the assembly from the end of the shaft.



STEP 3. Remove the oil brake cover.

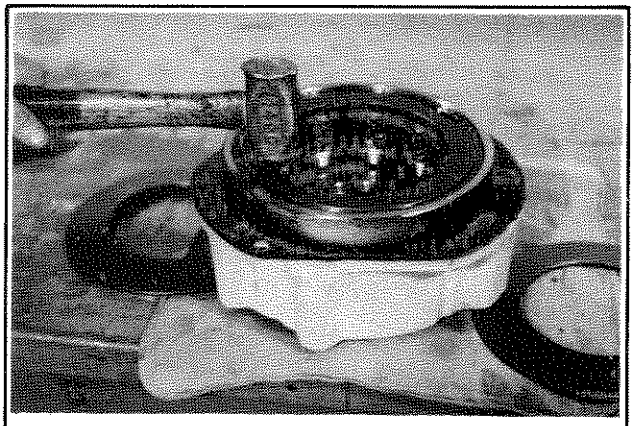


STEP 4. Remove the shims and inspect the shim surface. The surface must be smooth.



STEP 5. Remove the two Belleville springs.

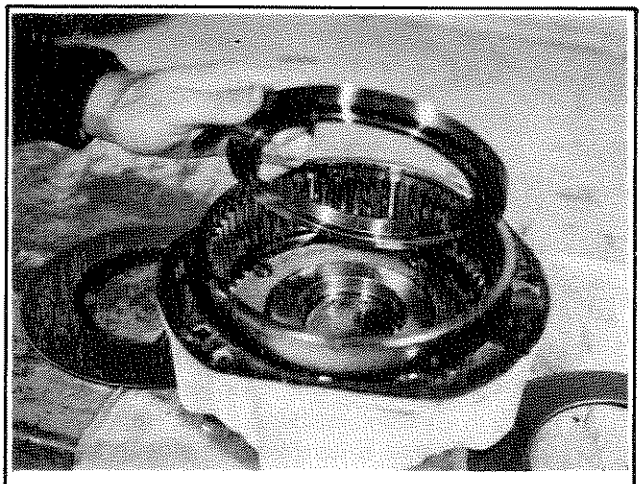
FIGURE 5-3. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (Sheet 1 of 3)



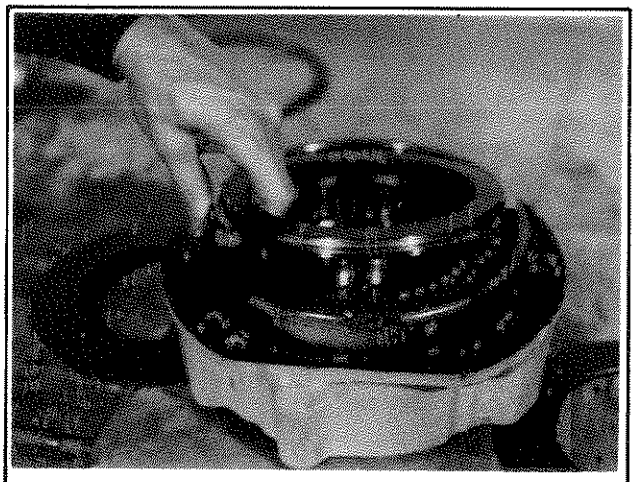
STEP 6. Use the two brake springs as a support for the brake housing. Hit the pressure ring to loosen the snap ring.

STEP 9. Remove the brake pack.

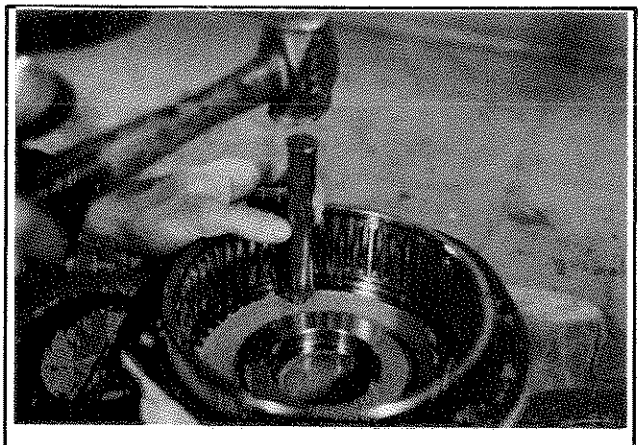
STEP 7. Remove the double snap ring.



STEP 10. Remove the thrust ring.

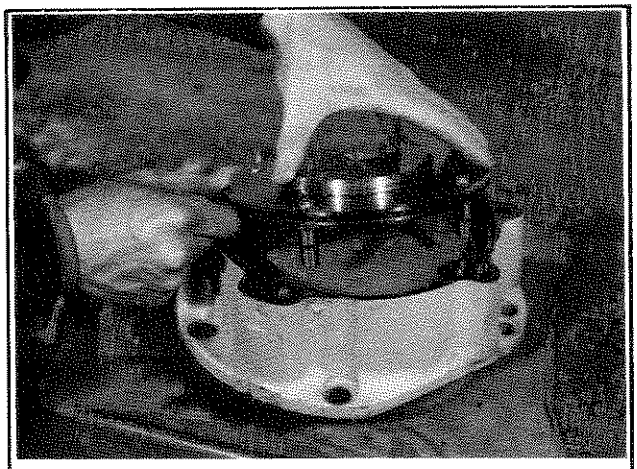


STEP 8. Remove the pressure ring.

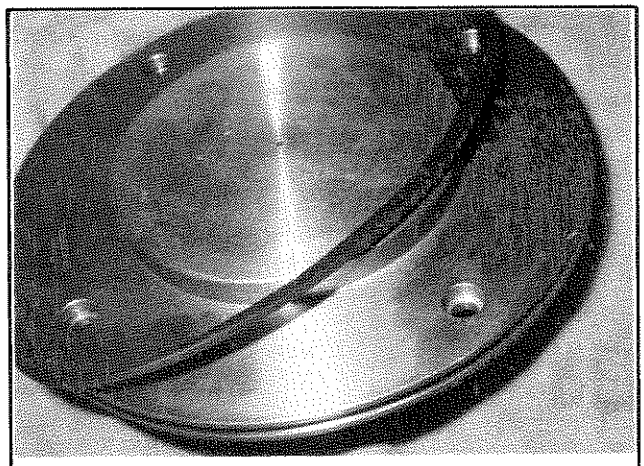


STEP 11. Push the plungers in the housing until they are even with the housing. Turn the assembly over.

FIGURE 5-3. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (Sheet 2 of 3)

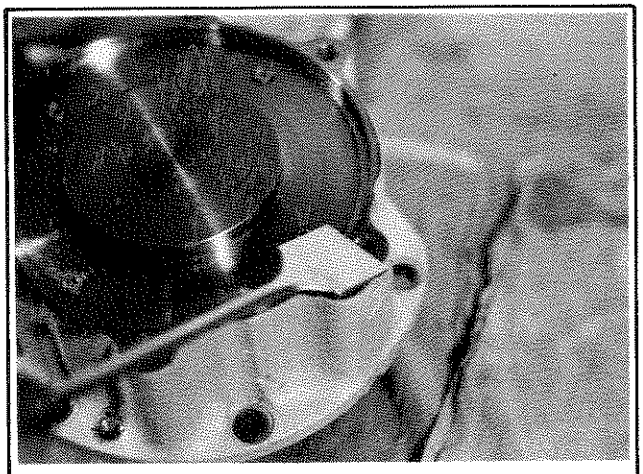


STEP 12. Remove the piston assembly.

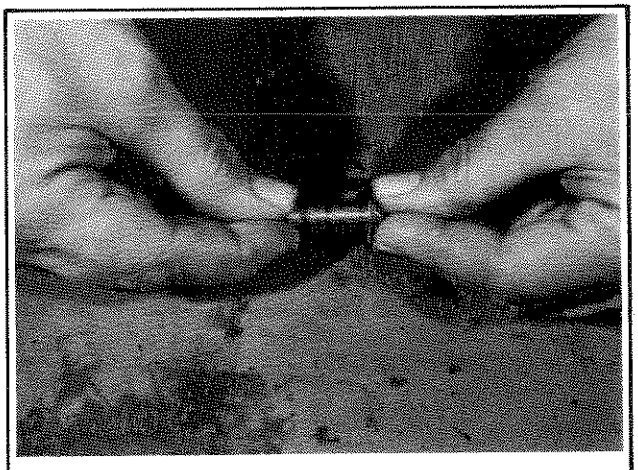


STEP 15. Remove the seal from the brake piston.

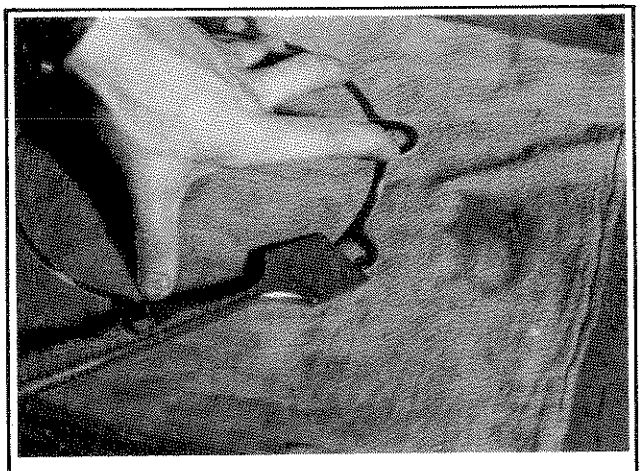
STEP 13. Remove the plunger from the piston housing. The plungers have a screwdriver slot in their end. Inspect the side of the plunger for damage.



STEP 16. Remove Loctite from piston housing.

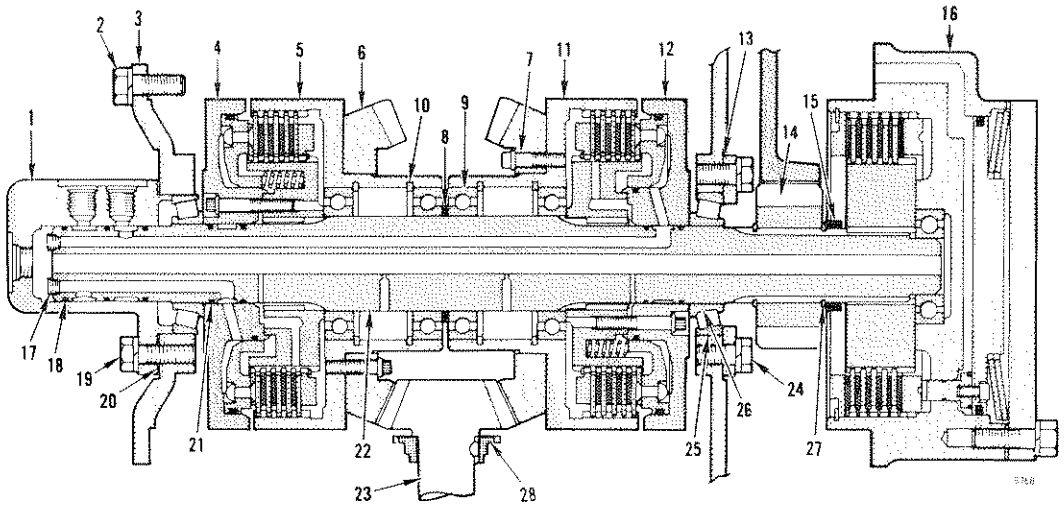


STEP 14. Remove the O-ring from the plunger.



STEP 17. Remove all of the Locktite from both sides of shims.

FIGURE 5-3. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (Sheet 3 of 3)



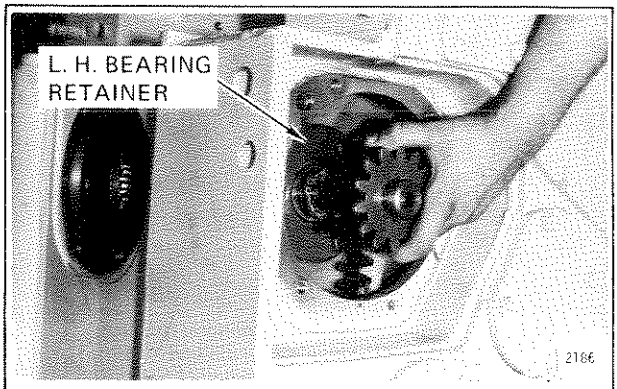
1. OIL MANIFOLD
2. CAPSCREW-LOCKWASHER
3. R. H. BEARING RETAINER
4. REVERSE CLUTCH ASSEMBLY
5. REVERSE CLUTCH CARRIER
6. BEVEL RING GEAR
7. SOCKET HEAD CAPSCREW
8. SNAP RING
9. BALL BEARING
10. SNAP RING
11. FORWARD CLUTCH CARRIER
12. FORWARD CLUTCH ASSEMBLY
13. SHIM (S)
14. INTERMEDIATE PINION GEAR
15. SPACER
16. OIL BRAKE ASSEMBLY
17. PLUG
18. SEAL RING
19. CAPSCREW-LOCKWASHER
20. SHIM (S)
21. O-RING
22. BEVEL GEAR & BRAKE SHAFT
23. PTO SHAFT
24. CAPSCREW-LOCKWASHER
25. BEARING CUP
26. BEARING CONE
27. SNAP RING
28. DRIVE SPROCKET

FIGURE 5-4. BEVEL GEAR AND BRAKE SHAFT, LOCATION OF COMPONENTS

NOTE

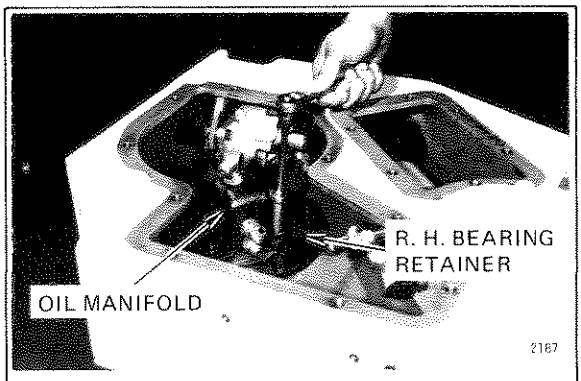
Prior to removal and disassembly of the bevel gear and brake shaft assembly, perform the procedures given in paragraph 5-14.

STEP 1. Remove the spacer and snap rings located on the L.H. side of the shaft (one snap ring on each side of the intermediate pinion gear).

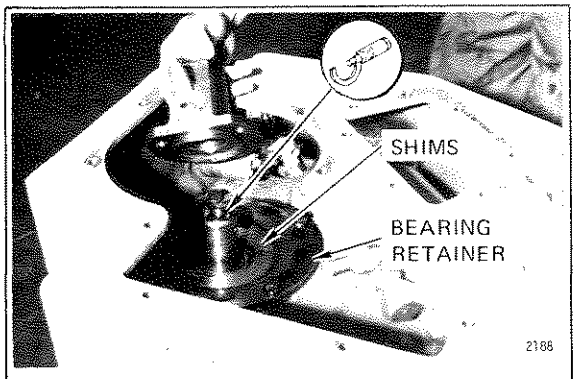


STEP 2. Remove the intermediate pinion gear. Then remove the L.H. bearing retainer and shim pack. Tag shims for reference during assembly. Do Not remove snap ring beteeen gear & bearing.

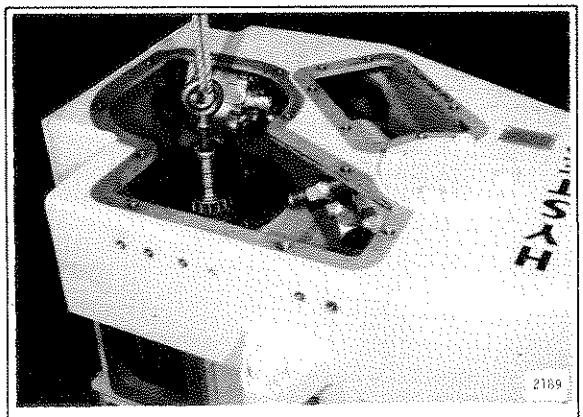
FIGURE 5-5. REMOVAL AND DISASSEMBLY OF BEVEL GEAR AND BRAKE SHAFT ASSEMBLY (Sheet 1 of 2)



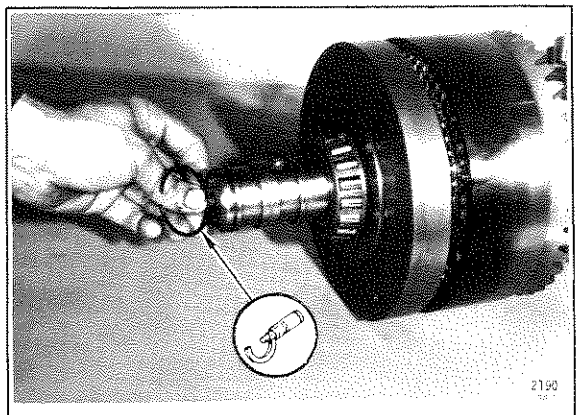
STEP 3. Remove the three capscrews from the oil manifold located on the RH side of the bevel gear and brake shaft.



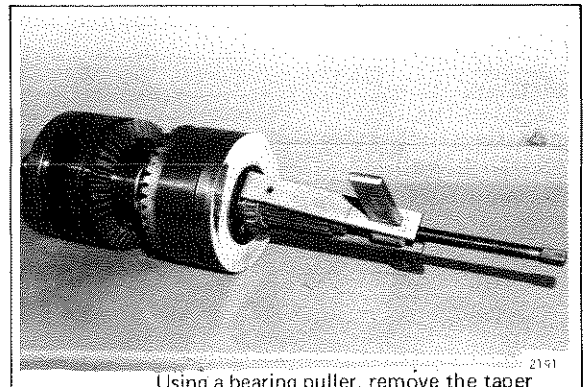
STEP 4. Remove the oil manifold, shims and retainer. Tag shims for reference during reassembly. Tubes may be left attached to oil manifold.



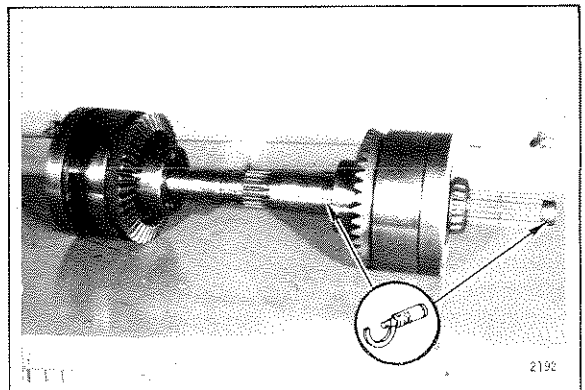
STEP 5. Using a 9/16 UNC eyebolt, pull the bevel gear and brake shaft straight out.



STEP 6. Remove the three cast iron seal rings.



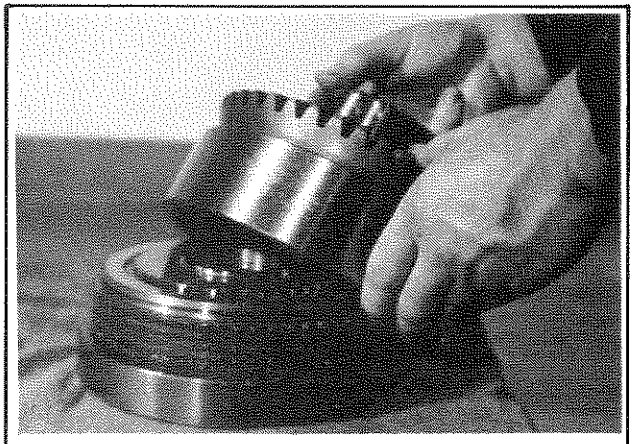
STEP 7. Using a bearing puller, remove the taper roller bearings (one on each end of the shaft). Bearing can be removed by placing end of shaft on wooden block and driving off using clutch assembly to impart the impact force.



STEP 8. Remove the carrier/bevel ring gear and clutch pack (s) as an assembly, remove the spacer.

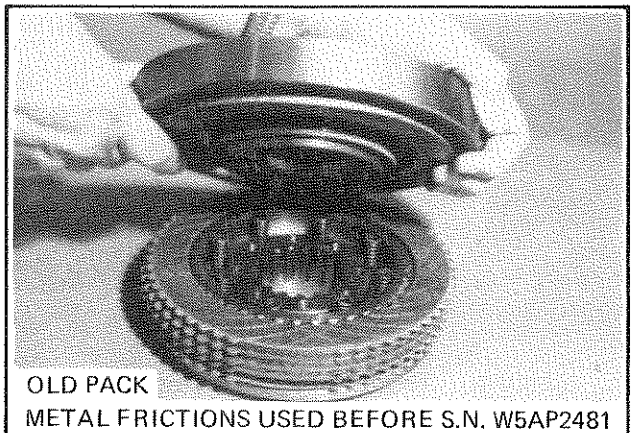
NOTE: When the bevel gear and brake shaft is removed with the winch mounted on the vehicle, the L.H. clutch assembly does not come out with the shaft. After the shaft and R.H. clutch are removed from the winch, the L.H. clutch pack is lowered to the bottom of the case and moved over to the R.H. side and lifted out the opening. On clockwise pump rotation units, it is necessary to press the suction hose downward to permit clutch pack to pass under bevel pinion gear.

FIGURE 5-5. REMOVAL AND DISASSEMBLY OF BEVEL GEAR AND BRAKE SHAFT ASSEMBLY (Sheet 2 of 2)



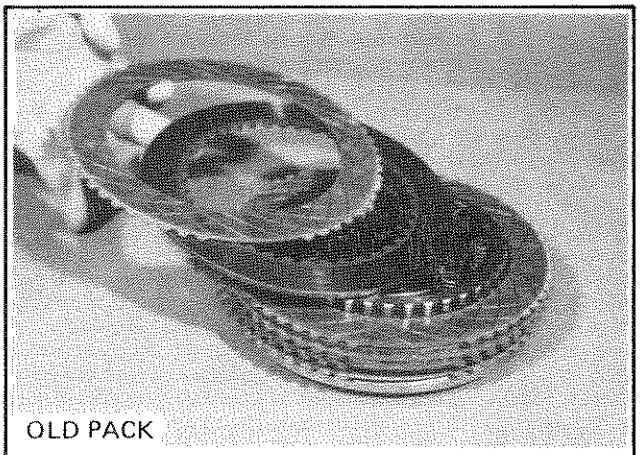
STEP 1. Lift clutch carrier from the clutch pack.

STEP 2 Clamp the clutch pack in a vise and loosen the 12 point capscrews using a 5/16 inch 12 point socket.



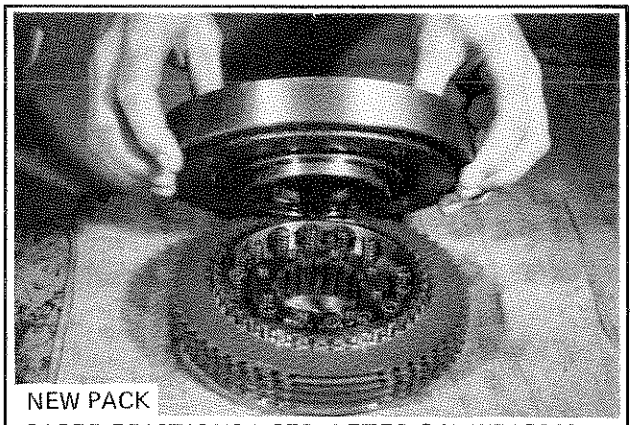
OLD PACK
METAL FRICTIONS USED BEFORE S.N. W5AP2481

STEP 3 Remove the cylinder from clutch pack. Lift the piston housing from the clutch pack.



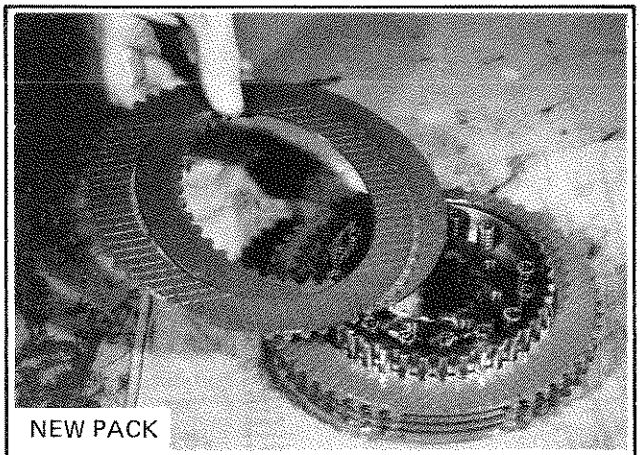
OLD PACK

STEP 4 Remove the friction discs and the separators from the hub.



NEW PACK
PAPER FRICTIONS USED AFTER S.N. W5AP2481

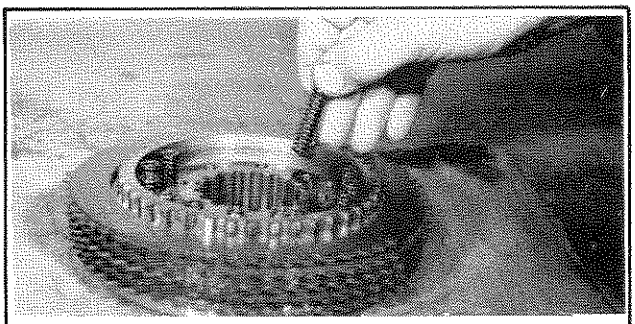
STEP 3 Remove the cylinder from clutch pack. Lift the piston housing from the clutch pack.



NEW PACK

STEP 4 Remove the friction discs and the separators from the hub.

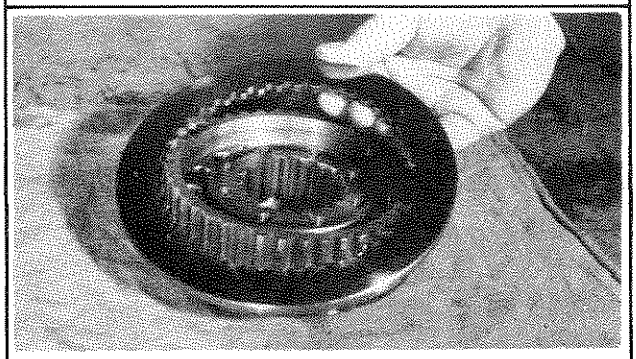
FIGURE 5-3. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (Sheet 1 of 2)



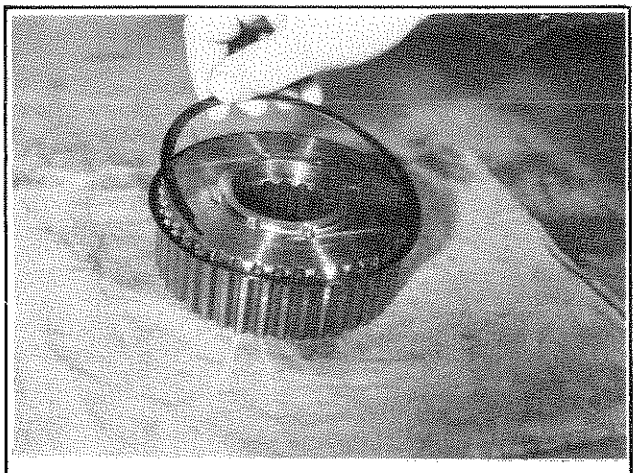
SPRING FORCE DATA

For bronze frictions:	For paper frictions:
8 Return springs	14 Return springs
1.20 in. free length	1.62 in. free length
40 lbs. force at 1.03 in.	18.5 lbs force at 1.35 in.

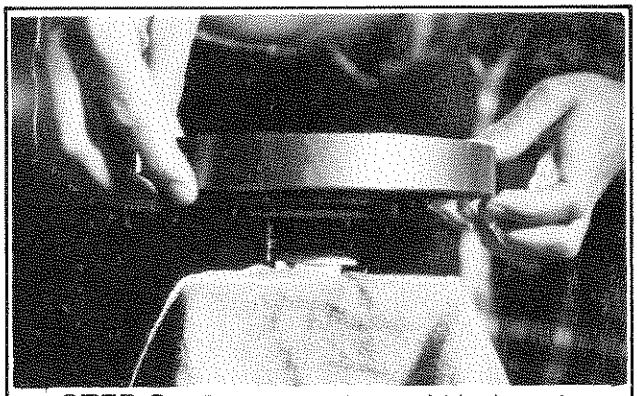
STEP 5. The springs must always be replaced when the clutch pack is rebuilt. Heat will damage the springs and the clutch will not release correctly. When the clutch does not release correctly, the winch will become too hot.



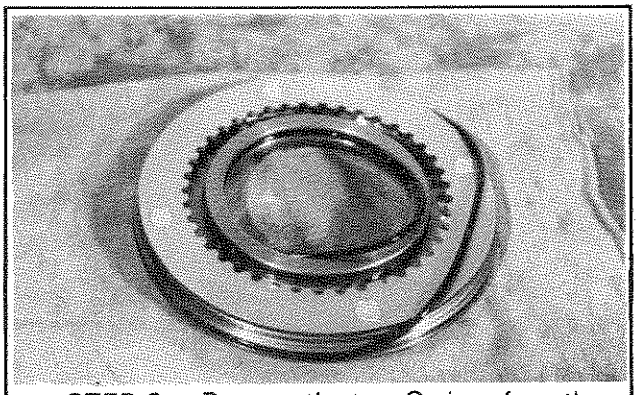
STEP 6. Remove the reaction plate. Inspect the plate for damage and make sure the surface is flat.



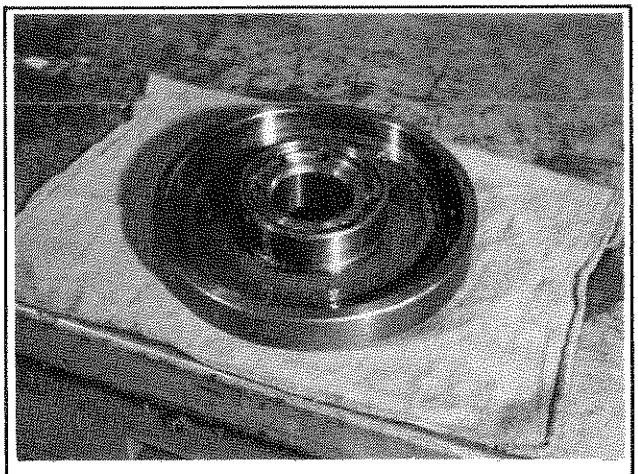
STEP 7. Check the snap ring for damage and replace it if necessary.



STEP 8. Put a round metal block against the center of the clutch cyinder. Hit the block with the assembly. The piston will drop out of the cylinder.

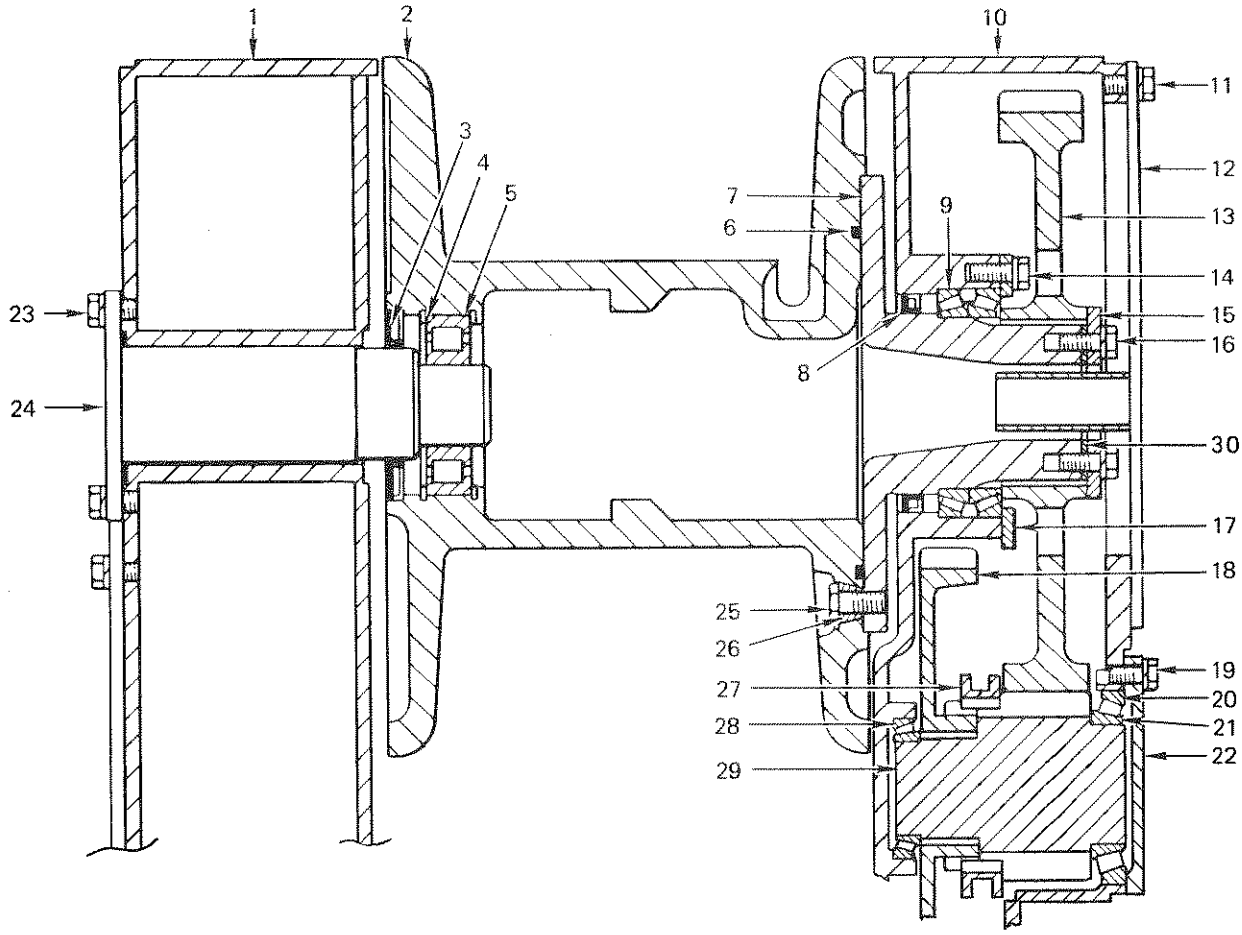


STEP 9. Remove the two O-rings from the piston. Discard the O-rings. Inspect and clean the O-ring grooves.



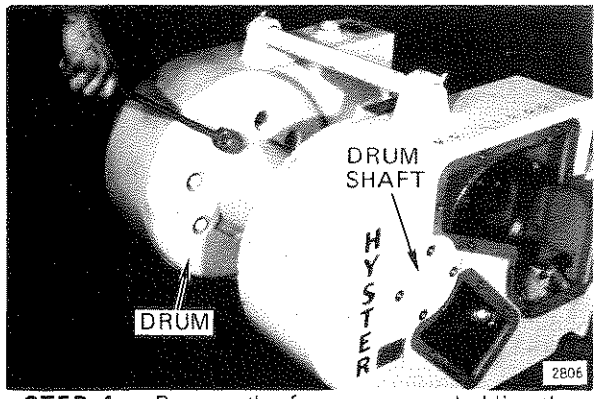
STEP 10. Inspect the O-ring surfaces for corrosion and damage.

FIGURE 5-3. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (Sheet 2 of 2)

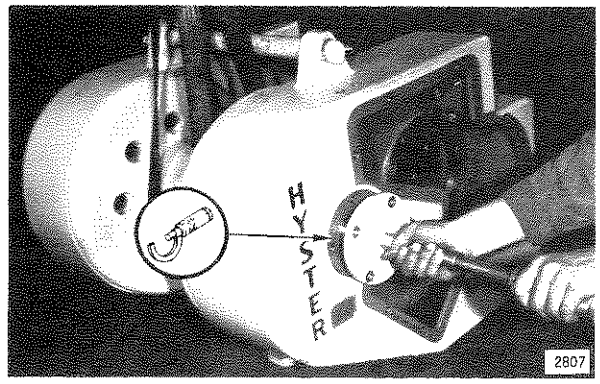


1. R.H.WINCH HOUSING
2. DRUM
3. OIL SEAL
4. SNAP RING
5. ROLLER BEARING
6. O-RING
7. DRUM ADAPTER
8. OIL SEAL
9. BEARING ASSEMBLY
10. L H.WINCH HOUSING
11. CAPSCREW-LOCKWASHER
12. DRUM GEAR ACCESS COVER
13. DRUM GEAR
14. CAPSCREW-LOCKWASHER
15. DRUM GEAR RETAINER
16. CAPSCREW-LOCKWASHER
17. BEARING RETAINER
18. INTERMEDIATE GEAR
19. CAPSCREW-LOCKWASHER
20. SHIM (S)
21. BEARING ASSEMBLY
22. BEARING RETAINER
23. CAPSCREW-LOCKWASHER
24. DRUM SHAFT
25. CAPSCREW
26. LOCKING DOWEL
27. DENTAL CLUTCH
28. BEARING ASSEMBLY
29. INTERMEDIATE SHAFT (DRUM PINION GEAR)
30. SHIMS

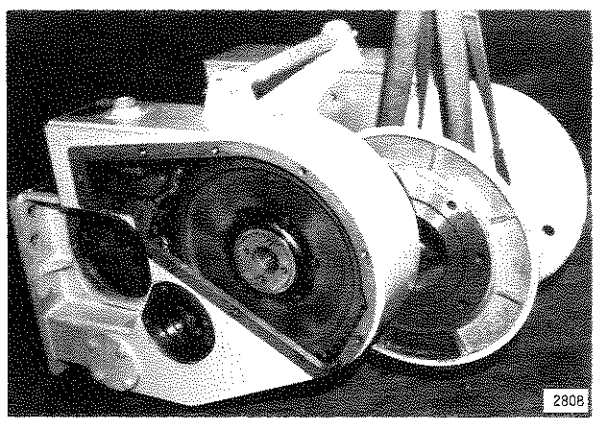
FIGURE 5-7. DRUM SHAFT AND DRUM COMPONENT LOCATION



STEP 1. Remove the four capscrews holding the shaft. Loosen the seven locking dowels and capscrews securing the drum, then remove five capscrews and dowels, leaving two dowels and capscrews located 180 degrees apart.

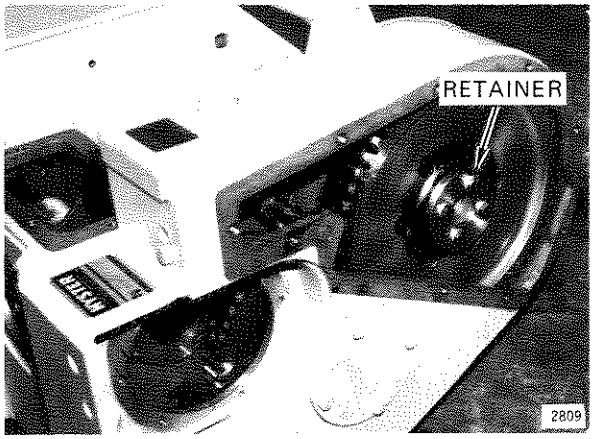


STEP 2. Install a sling around the drum. Hoist until sling just starts to lift drum. Then using a slide hammer remove the drum shaft.

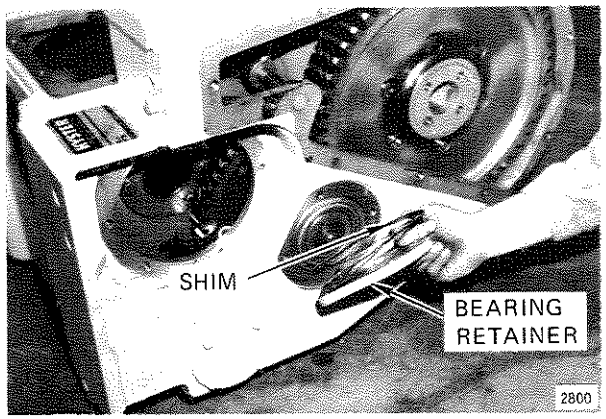


STEP 3. Remove the two remaining locking dowels and drum capscrews. Using the sling, pull the drum straight out.

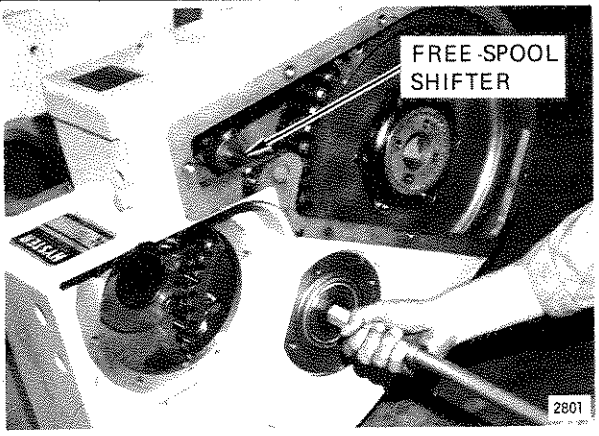
FIGURE 5-8. REMOVAL OF DRUM AND DRUM SHAFT



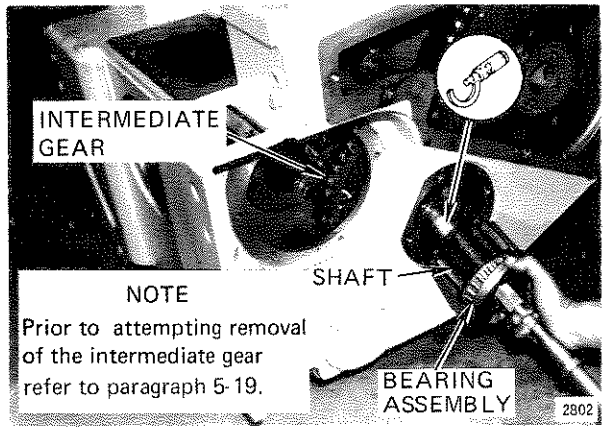
STEP 1. Remove the four capscrews and retainer from drum gear.



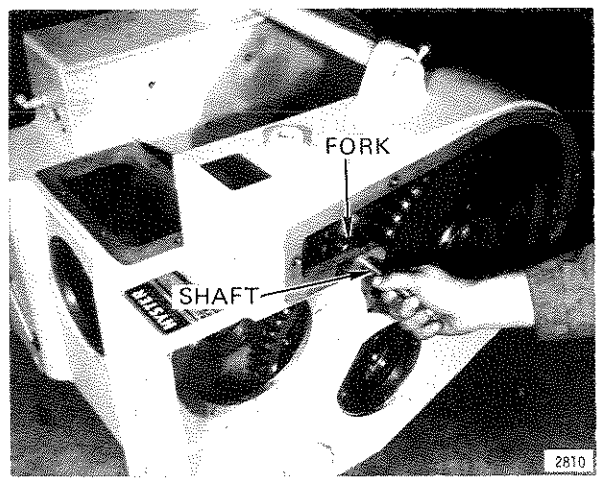
STEP 2. Remove four capscrews, bearing retainer and shims from the intermediate shaft. Tag shims for reference during reassembly.



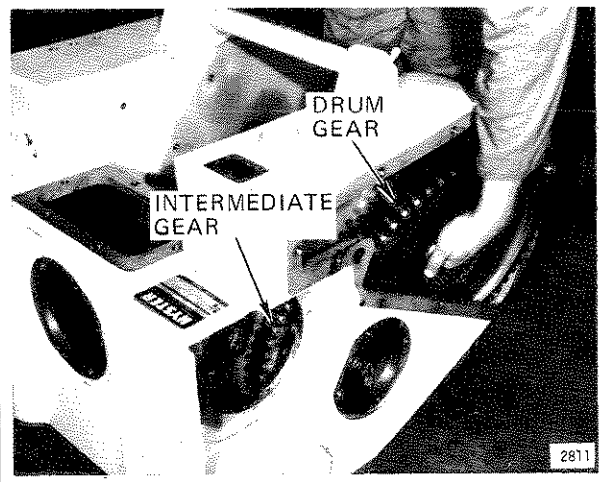
STEP 3. Screw a 1/2-UNC thread slide-hammer into the end of the intermediate shaft (drum pinion gear).



STEP 4. Pull the intermediate shaft (drum pinion gear) and bearing assembly straight out.

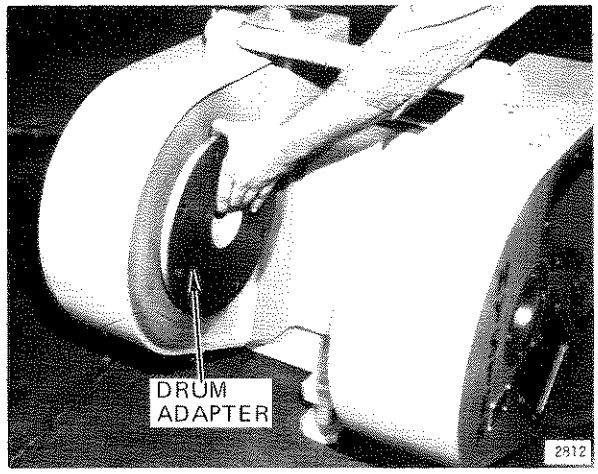


STEP 5. Remove free spool shifter shaft and move fork out of the way.

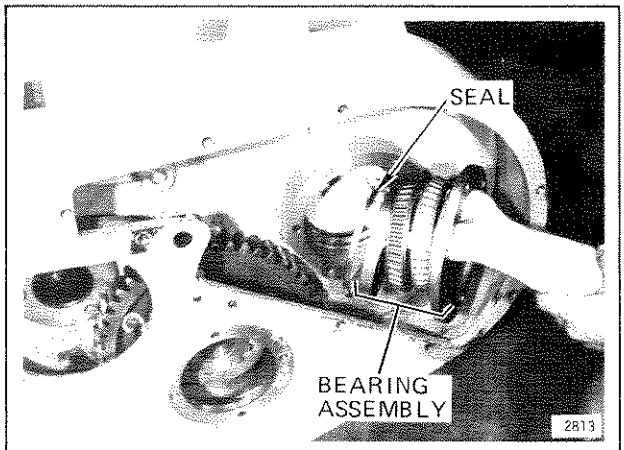


STEP 6. Remove drum gear and free spool shifter fork.

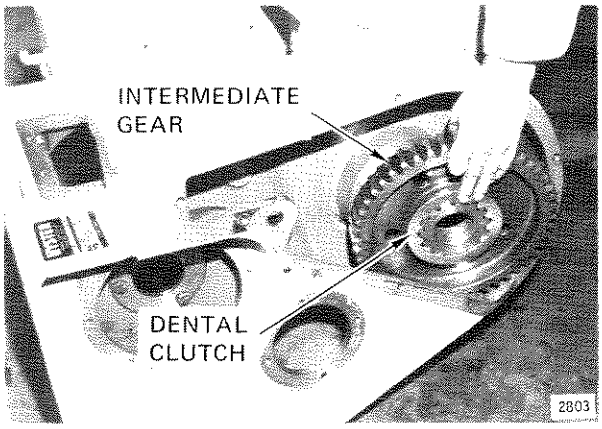
FIGURE 5-9. REMOVAL OF INTERMEDIATE SHAFT AND DRUM GEAR ASSEMBLIES (Sheet 1 of 2)



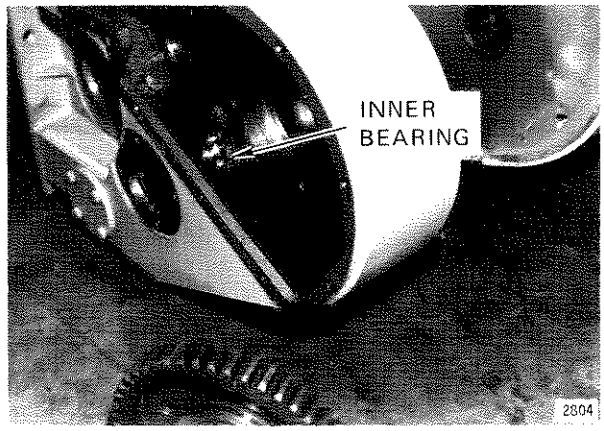
STEP 7. Remove drum adapter.



STEP 8. Remove bearing retainer by removing the six capscrews. The bearing assembly and oil seal may now be removed.



STEP 9. Remove the intermediate gear.



STEP 10. Removal of the intermediate shaft inner bearing is not necessary unless damage to the bearing or gear is evident.

FIGURE 5-9. REMOVAL OF INTERMEDIATE SHAFT AND DRUM GEAR ASSEMBLIES (Sheet 2 of 2)

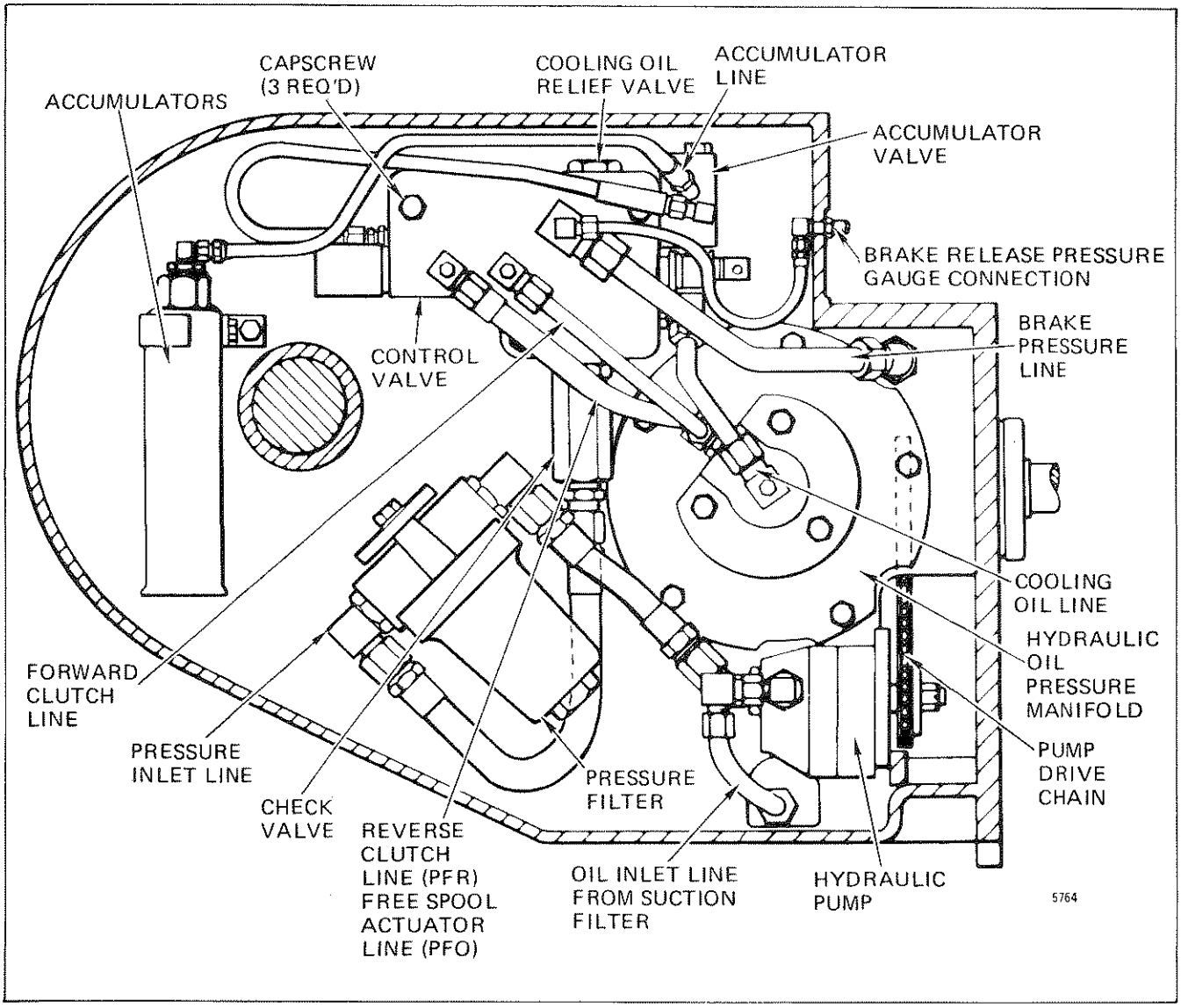


FIGURE 5-10. CONTROL VALVE REPAIR (Sheet 1 of 3)

NOTE: For older models also refer to parts manual 599680 page 1D09.

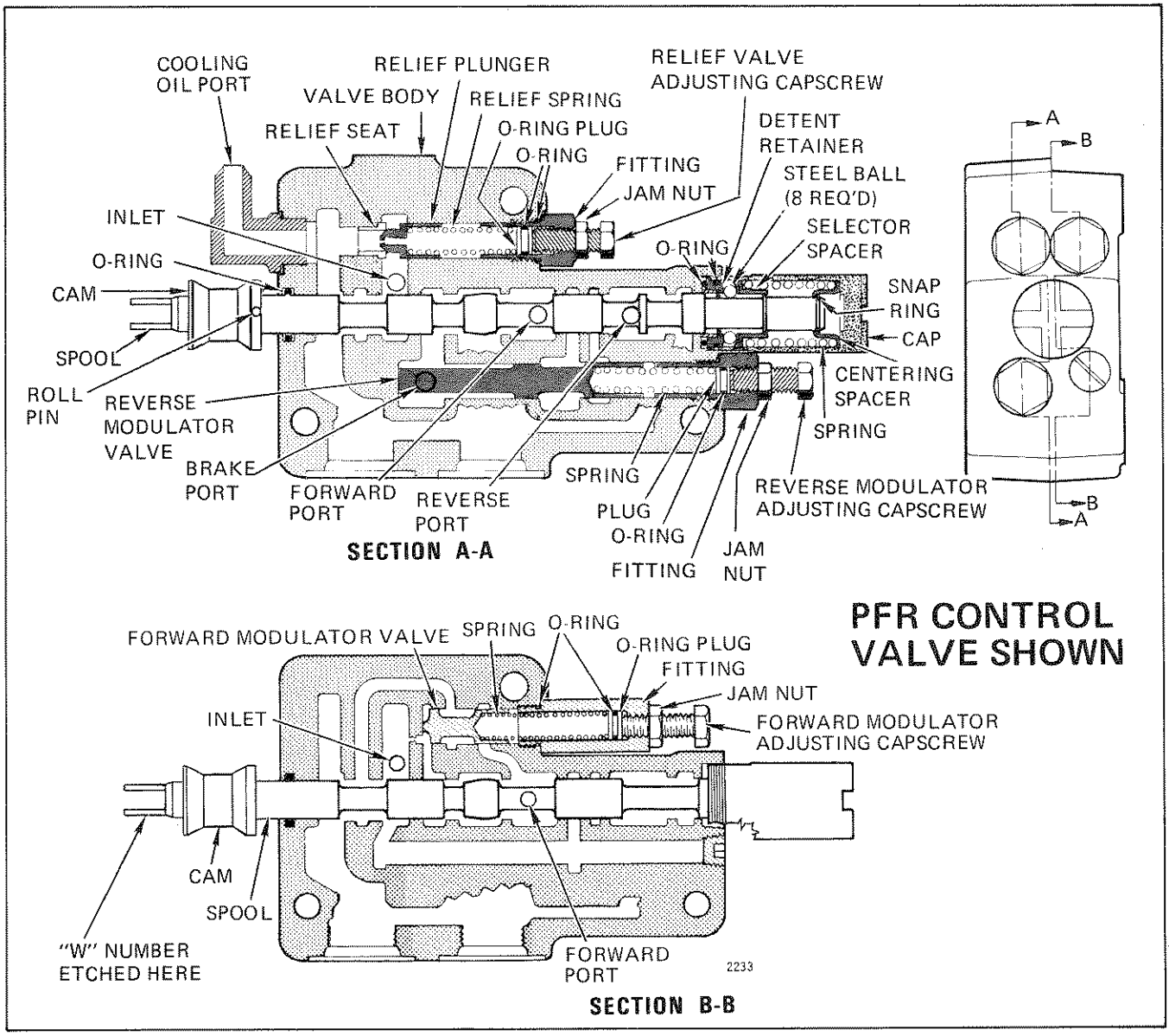


FIGURE 5-10. CONTROL VALVE REPAIR (Sheet 2 of 3)

NOTE: To remove Roll Pin set valve up on end and support the cam. Using impact force of valve to shear Roll Pin. The three pieces can then be easily removed. The cam must be removed prior to removing the spool from the valve body. Spool is removed by loosening the Spool Cap.

The Spool Cap should be tightened by hand until O-ring resistance is felt, then tighten with slip-joint pliers 1/16 rotation additional. (Locktite may be used on threads.)

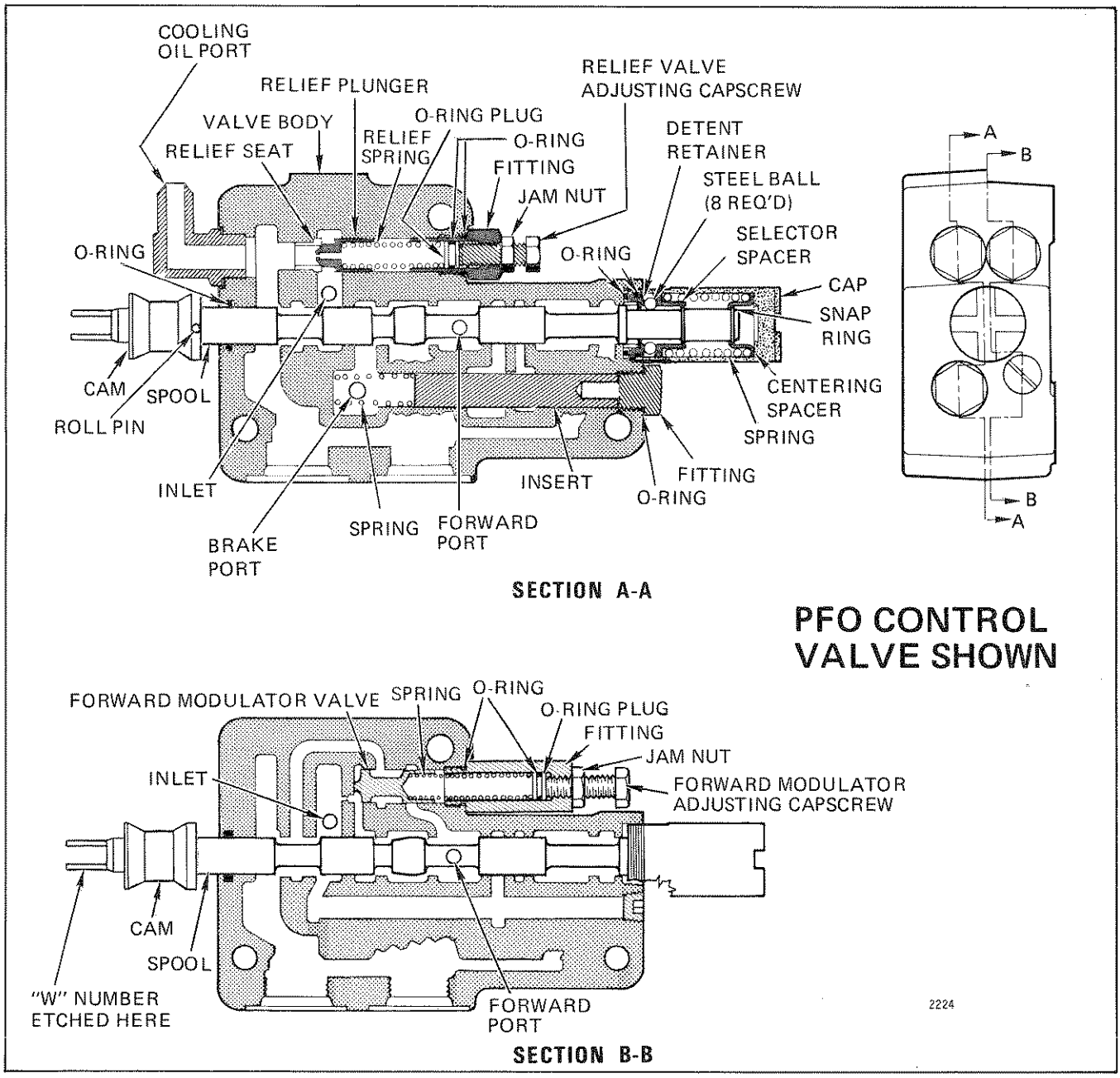
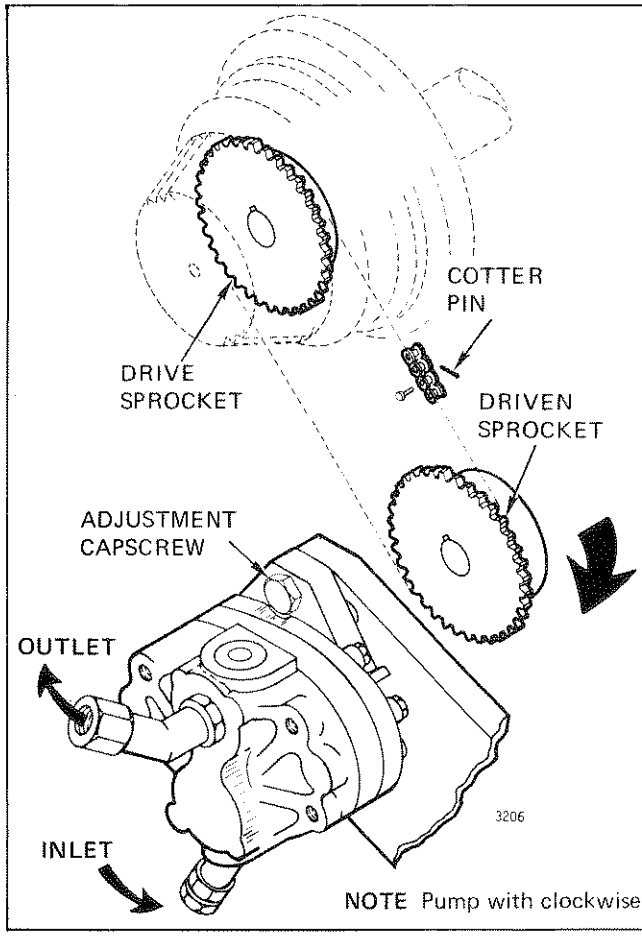


FIGURE 5-10. CONTROL VALVE REPAIR (Sheet 3 of 3)



STEP 1. Loosen the pump mounting capscrews. Move pump to slacken driven chain. Remove chain by removing cotter pin from master link and lifting out of transmission compartment.

STEP 2. Disconnect hydraulic lines at pump and remove pump.

NOTE Pump with clockwise rotation shown.

FIGURE 5-11. REMOVAL OF HYDRAULIC PUMP

TABLE 5-1. VISUAL INSPECTION (Sheet 1 of 3)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
PTO Shaft (Integral Bevel Pinion Gear)	Check for uneven wear pattern.	Reset PTO shaft back lash or bevel gear and brake shaft preload.
	Check for broken or worn bevel gear teeth. Also check spline for wear or twisting.	Replace shaft if gear teeth are broken, severely worn or if splines are not true.
Pump Drive Sprockets and Chain.	Check for broken or worn sprocket teeth. Also check chain for worn or broken links. Check for worn keys.	Replace sprocket if teeth are broken or worn. Replace links or chain if severely worn.
Bevel Gear and Brake Shaft	Check for deep scratches or scored journals under bearings at each end of shaft.	Dress surface or replace shaft if severely worn.
	Check for broken, scored, pitted, and corroded cast iron seal rings.	Replace seal rings if worn or damaged slightly.
	Inspect bevel gear shaft seal ring grooves for taper, scoring, burrs, and corrosion. Clean oil orifices.	Replace or repair shaft if mating surfaces between the inner side of groove and seal are not FLAT.
Bevel Gear and Brake Bearing Retainers	Check retainer bearing bore and seal ring bore for grooves, scoring and rust.	Replace if scored or rusted.
	Spacer on center of shaft	Replace if scored.
Bevel Gear	Check for uneven wear pattern.	Reset PTO shaft back lash or bevel gear and brake shaft preload.
	Check for broken or worn teeth.	Replace if teeth are broken or severely worn.
	Inspect gear hub faces for scoring, mushrooming, or corrosion.	The gear should be replaced if the hub faces are defective in any way.
Intermediate Pinion Gear	Check for broken or worn teeth.	Replace if teeth are broken or severely worn.
Clutch Assembly	Check for plugged oil holes in clutch hub.	Clean oil holes as necessary.
	Carefully inspect friction discs for facing wear, distortion, and damaged teeth.	Replace friction disc if oil grooves are worn or if distorted in any way.
	Carefully inspect separator plates to verify that surfaces are not worn excessively or unevenly. Plates must be flat.	Replace separator plates if conical surface is flat, or if other surfaces are warped, or blue from overheat.
	Inspect piston, piston housing, piston O-ring grooves, and center bore for scoring, burrs, and corrosion.	Replace piston or piston housing if damaged.
	Check for weak or collapsed release springs.	Replace spring(s) if clutch pack has been overheated.

TABLE 5-1. VISUAL INSPECTION (Sheet 2 of 3)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
Oil Brake Assembly	Check plungers for galling, mushrooming, and end faces out of square.	Replace if damaged in any way.
	Check for cracked or broken belleville springs or evidence of spring collapse.	Replace springs if cracked or broken.
	Inspect oil brake cover for cracks, warpage or bowing.	Replace cover if damage affects sealing or proper contact with belleville springs.
	Inspect thrust ring face for grooves or surface depressions.	Replace ring if surfaces are excessively worn.
	Carefully inspect friction discs for facing wear, distortion, and damaged teeth.	Replace friction discs if oil grooves are worn or distorted in any way.
	Carefully inspect separator plates to verify that surfaces are not worn excessively or unevenly.	Replace separator plates if surfaces are warped or scored.
	Inspect piston for scoring, burrs, and corrosion.	Replace piston if damaged.
	Inspect brake housing for wear, scoring burrs, and cracks.	Replace housing if splines are notched or cage is cracked.
	Inspect brake hub for wear, scoring, burrs, and cracks.	Replace hub is splines are notched or hub is cracked.
Control Valve Cam	Carefully inspect cam for facing wear and scoring.	Replace cam if wear is excessive.
Brake Accumulator Control Valve Plunger	Check plunger for grooves mushrooming and cracks or other defects.	Replace if damaged enough to cause binding.
Intermediate Shaft (Drum Pinion Gear)	Check for deep scratches or scoring on bearing surfaces at each end of shaft	Dress surface or replace shaft if severely worn.
	Check for broken or severely worn gear teeth or splines.	Replace if broken or severely worn.
Dental Clutch Free-Spool	Check for broken or severely worn teeth.	Replace shifting collar if teeth are broken or severly worn.
Free-Spool Fork	Check fork for wear and gear interference.	Replace and correct for interference.

TABLE 5-1. VISUAL INSPECTION (Sheet 3 of 3)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
Intermediate Gear	Inspect gear for broken or severely worn teeth. Pay particular attention to leading edges of straight-cut gear teeth. Check bushing for wear.	Replace gears if teeth are broken or severely worn.
Drum Shaft	Check for deep scratches or scoring on bearing surface end of shaft.	Dress surface or replace shaft if severely worn.
	Inspect RH seal surface for corrosion.	Remove corrosion with fine abrasive cloth or paper as necessary.
Drum Gear	Check for broken or severely worn gear teeth. Pay particular attention to leading edges of straight-cut gear teeth.	Replace gear if teeth are broken or severely worn.
Drum Adapter	Carefully inspect seal contact surface for deep scratches, burrs, and rust.	Replace if damaged.
	Check for deep scratches or scoring on bearing surface.	Replace if damaged.
Control Valve	Inspect for galling & grooving. Check for broken parts.	Replace worn and damaged parts.

5-33. Accumulator Valve.

5-34. Do not repair. Replace complete assembly if the accumulator valve is defective.

5-35. Hydraulic Pump Assembly.

5-36. Seal wear or deterioration are the most common failures occurring in the hydraulic pump. The pump bearings, gears and shaft are subject to wear and should be checked when the pump is disassembled. Do not attempt to machine or otherwise repair these parts. To prevent future failures, always replace parts that are worn or damaged. If severe pump wear or damage is evident, replacement of the complete pump is recommended.

5-37. REASSEMBLY AND INSTALLATION.

5-38. Before reassembly and installation of the winch, make sure that all removed parts have been inspected as specified in Table 5-1. Check all parts specified in Table 5-1 and as shown in the disassembly illustrations. Replace any worn parts. Carefully check all bearings that have been removed. Used bearings often appear to be satisfactory, but may fail when placed under a load. When in doubt, installation of new bearings is recommended to prevent future troubles.

CAUTION Apply a light coat of sealing compound (John Crane, or equal) to all external bearing retainers and cover plate capscrews.

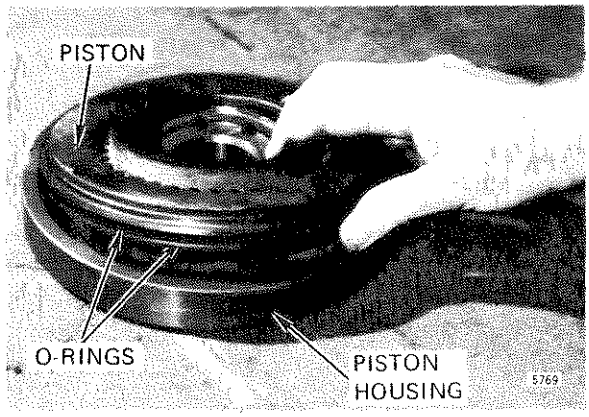
5-39. Reassembly of Oil Clutch Assembly.

5-40. Reassembly of the oil clutch is shown in Figure 5-12.

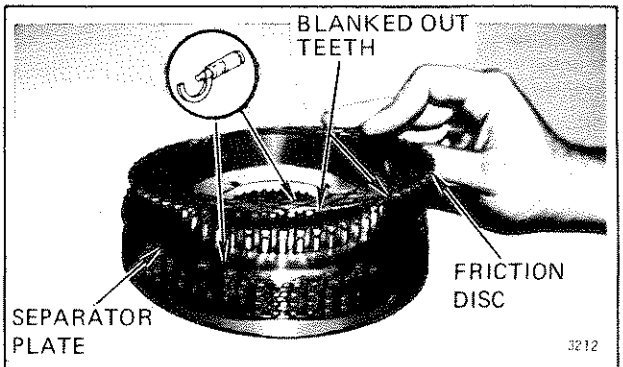
CAUTION Make certain that all parts have been thoroughly cleaned prior to reassembly. Dirt particles will seriously affect operation of the clutch assembly.

5-41. Installation of Intermediate and Drum Gear Assemblies.

5-42. Installation of the Intermediate Shaft and associated components is shown in Figure 5-13. Fig

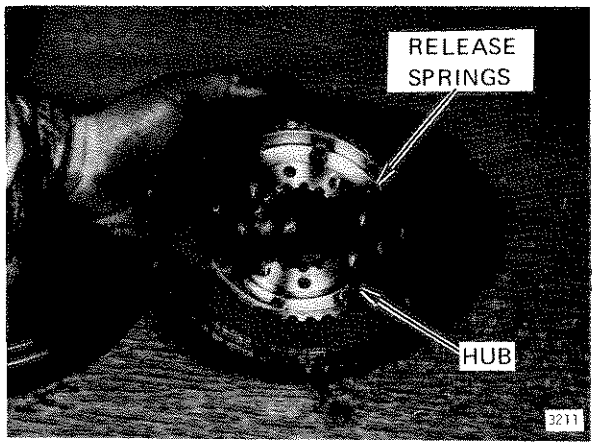


STEP 1. Install two new O-rings. Lubricate piston housing cavity. Check rivets to be sure separator is held tightly.



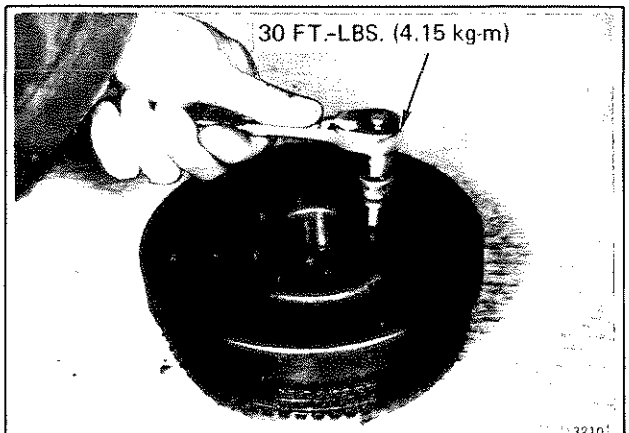
STEP 2. Starting with a friction disc next to the piston, alternately place the five friction discs and four separator plates on the clutch hub.

NOTE Keep the blanked out teeth of the friction discs in line.



STEP 3. Install the eight release springs in the hub.

STEP 4 Assemble the hub and piston housing. Be careful to align bolt holes as well as splines.

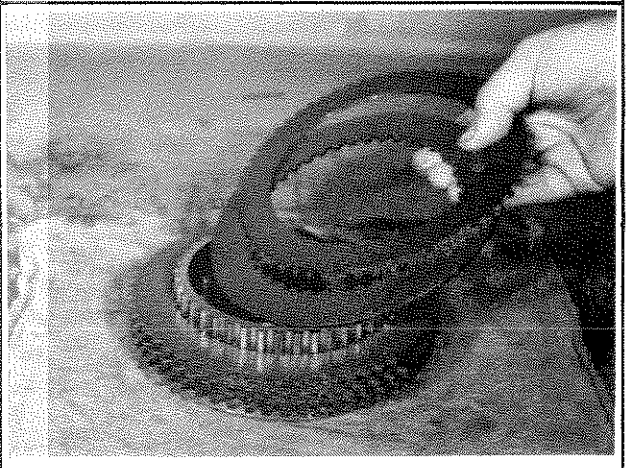


STEP 5. Install capscrews, tighten to 30 ft.-lbs. (4.15 kg-m) torque.

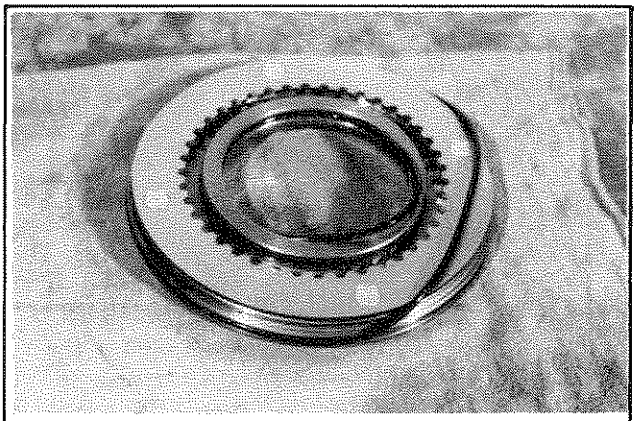
NOTE Use 5/16 inch, twelve-point socket.

FIGURE 5-12. REASSEMBLY OF OIL CLUTCH PRIOR TO S/N W5AP2482 (Sheet 1 of 3)

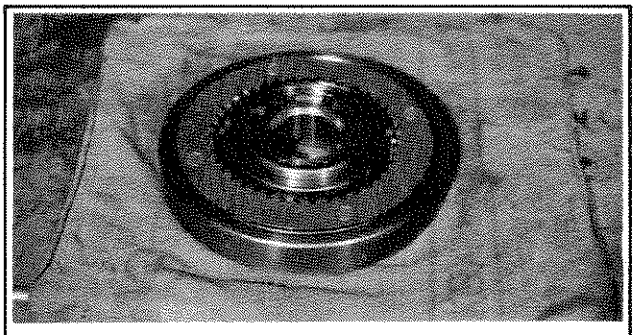
STEP 1. Install a new snap ring on the hub if necessary. Install the reaction plate with the counterbore against the snap ring.



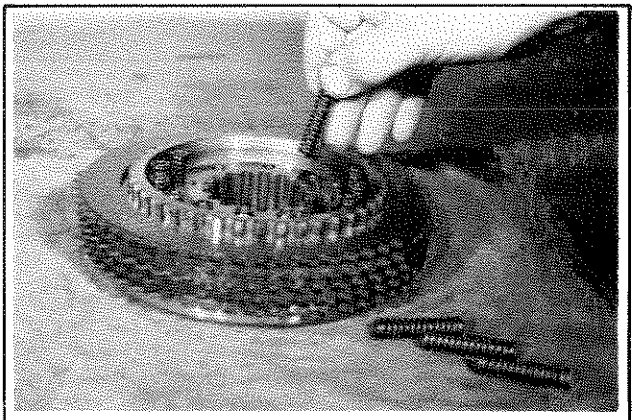
STEP 2. Install a friction plate and then a metal separator on the hub. Install the remainder of the clutch pack in the same sequence. A friction disc will be on the top of the pack when the assembly is correct. There are five friction discs and four metal separators.



STEP 3. Install new inner and outer o-rings on the clutch piston. Lubricate the O-rings with hydraulic oil or O-ring lubricant.

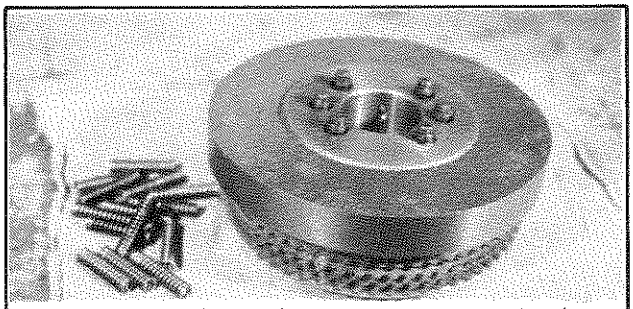


STEP 4. Lubricate the piston and cylinder bores with hydraulic oil or O-ring lubricant. Push the piston evenly to the base of the housing. Make sure the O-rings are not damaged.

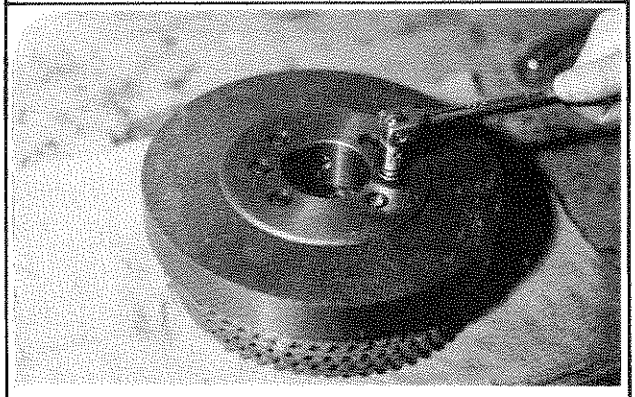


STEP 5. Install the springs in the hub.

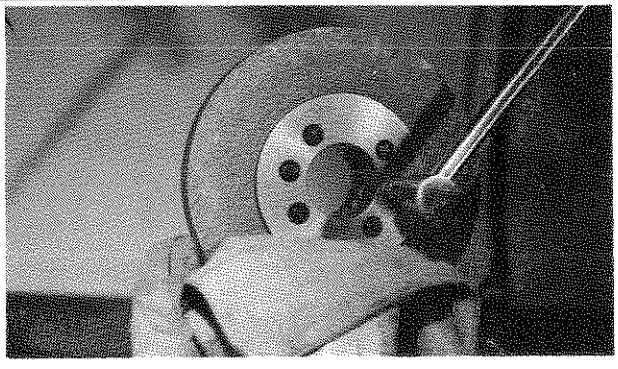
FIGURE 5-12. REASSEMBLY OF OIL CLUTCH AFTER S/N W5AP2482 (Sheet 2 of 3)



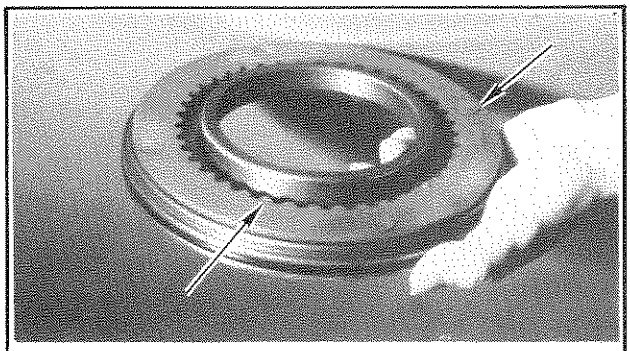
STEP 6. Align the capscrew holes in the piston housing with the threaded holes in the hub. Align the splines of the hub with the separator. Also engage the splines for a test fit.



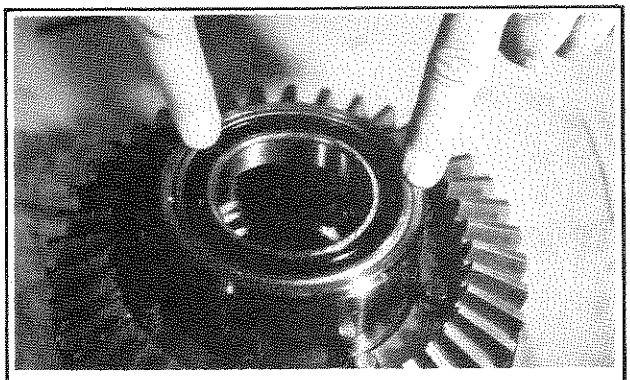
STEP 7. Tighten the capscrews carefully while checking the alignment of the hub splines in the piston. Put the housing to the hub and align the capscrew holes. Align the splines of the hub with the piston separator. Install the Hi-tork lockwashers and capscrews.



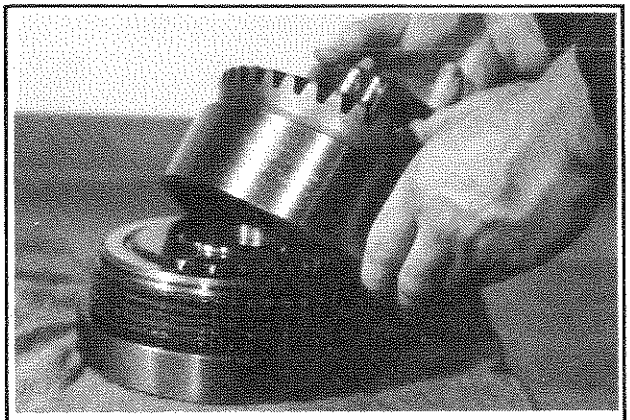
STEP 8. Tighten the capscrews to a torque of 30 ft lb (40 N.m). Use a 5/16 inch 12 point socket.



STEP 9. The hub splines were not aligned with the separator in step 5 and 7. The separator is bent. The rivets have moved up above the surface of the separator. Note the marks where the hub pushed against the separator plate.

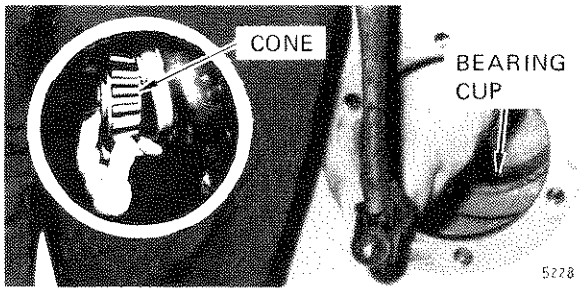


STEP 10. Install a new bearing in the clutch carrier. The top bearing must have the seal towards the top. The lower bearing does not have seals.

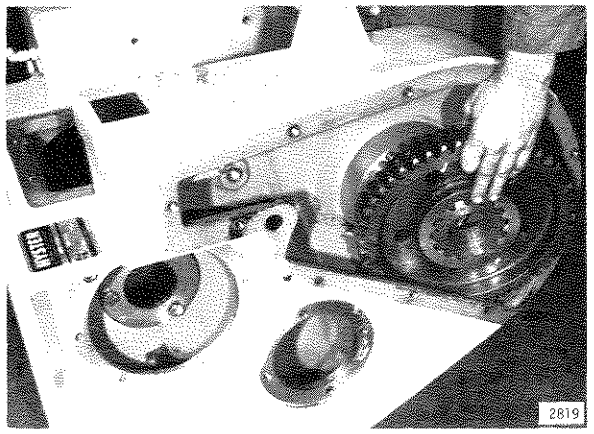


STEP 11. Align the spaces on the frictions discs. Install the carrier on the clutch pack.

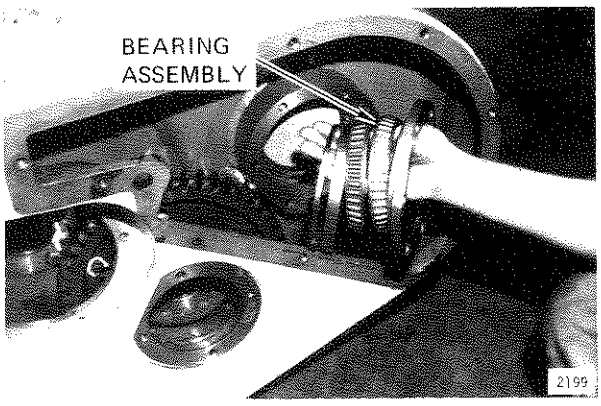
FIGURE 5-12. REASSEMBLY OF OIL CLUTCH AFTER S/N W5AP2482 (Sheet 3 of 3)



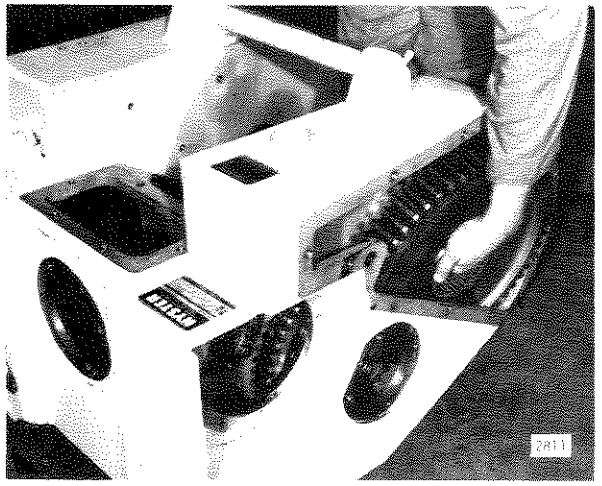
STEP 1. Install intermediate shaft inner bearing assembly if previously removed. Use a liberal amount of Lubriplate or other light lube grease to hold the inner bearing cone in place.



STEP 2. Install the intermediate gear and free-spool shifter fork loose in the frame.



STEP 3. Install drum adapter bearing assembly and related parts as shown. Tighten the six bearing retainer capscrews to 75 ft.-lbs. (10.37 kg-m) torque.



STEP 4. Install the drum gear in the frame.

FIGURE 5-13. INSTALLATION OF INTERMEDIATE SHAFT AND DRUM GEAR ASSEMBLIES (Sheet 1 of 2)

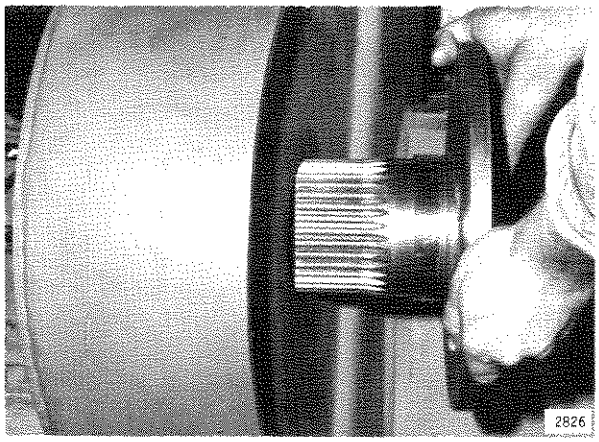
ure 5-13 shows the winch removed from the tractor with the bevel gear and brake shaft removed. However, the intermediate shaft can be installed with the winch mounted on the tractor and with only the drum gear removed for the necessary clearance.

5-43. Installation of Drum and Drum Shaft.

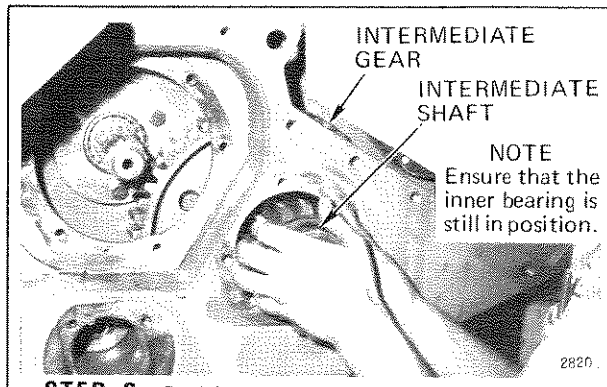
5-44. Reassembly and installation of the drum and drum shaft is shown in Figure 5-14. Location of components is shown in Figure 5-7. Installation of the drum and drum shaft can be accomplished with the winch mounted on the vehicle in most cases.

5-45. Reassembly and Installation of Bevel Gear and Brake Shaft Assembly.

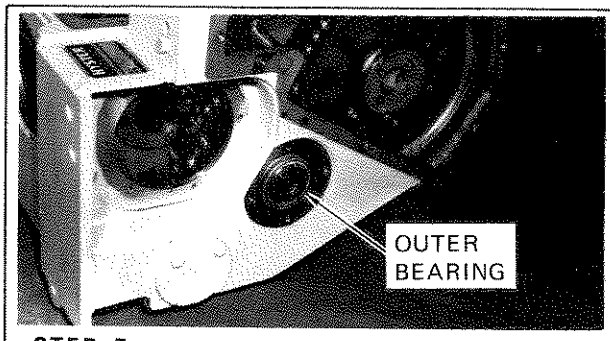
5-46. Reassembly and installation of the bevel gear and brake shaft assembly is shown in Figure 5-15. Installation of the bevel gear and brake shaft can be accomplished with the winch mounted on



STEP 5. Install the drum adapter by pushing it through the double lip seal. Lube sealing surface on drum adapter.

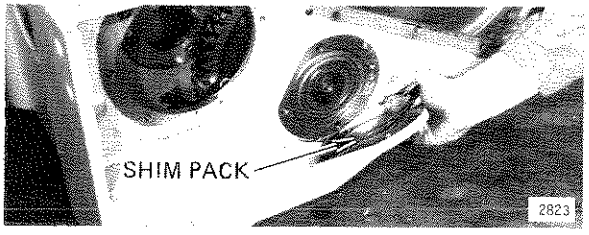


STEP 6. Position the intermediate gear, dental clutch and shifter fork in the frame to install the intermediate shaft (drum pinion gear). Install rounded teeth on dental clutch facing out. Push the shaft through the intermediate gear and into the inner bearing.

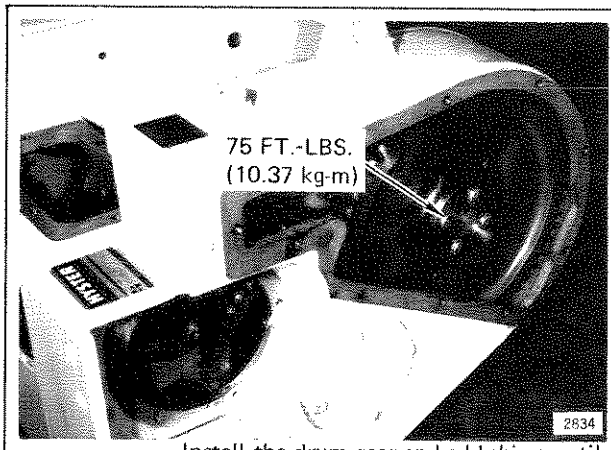


STEP 7. Install the outer bearing cone and cup. Make sure that the bearing cup is firmly seated against the cone.

STEP 8. Push the free-spool shifter shaft through the hole in the housing with the shifter fork in place. Then on PFR winches install the detent ball, spring and special plug. Lockwire securely. On PFO winches install the hydraulic actuator.

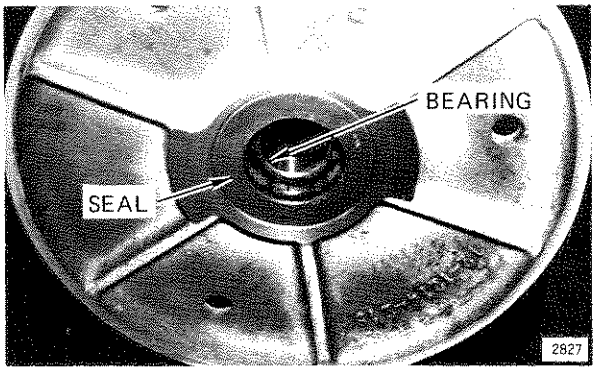


Install the retainer with the shim pack as tagged during removal. Tighten capscrews to 75 ft.-lbs. (10.37 kg-m) torque. Place the winch in FREE-SPOOL and measure the rolling torque of the drum by placing a 25 ft.-lb. (3.5 kg-m) torque wrench on one of the eight drum nuts (keep the wrench handle pointed straight out from the drum center). On crawler tractors the torque should be 12-15ft.-lbs. (1.7-2.0 kg-m), for rubber tired skidders the torque should be 20-25 ft.-lbs. (2.8-3.5 kg-m). Add or remove shims from the intermediate shaft retainer to reduce or increase torque respectively.

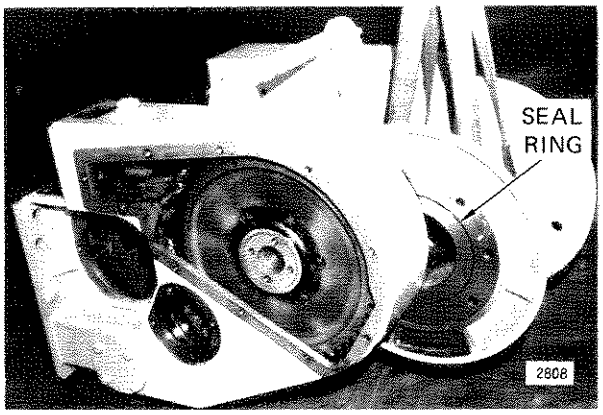


STEP 10. Install the drum gear and add shims until shimpack is .000 to .035 below edge of gear. Tighten the four capscrews to 75 ft.-lbs. (10.37 kg-m) torque.

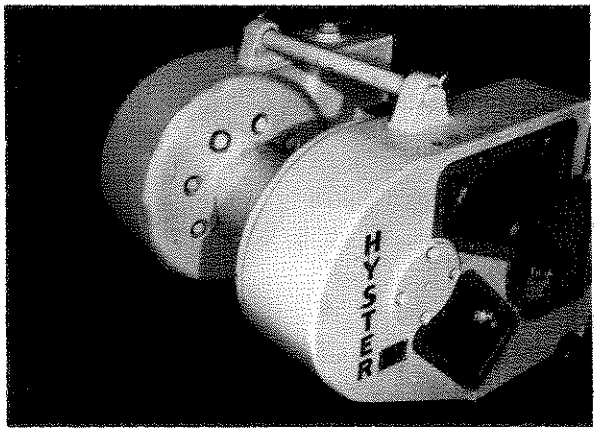
FIGURE 5-13. INSTALLATION OF INTERMEDIATE SHAFT AND DRUM GEAR ASSEMBLIES (Sheet 2 of 2)



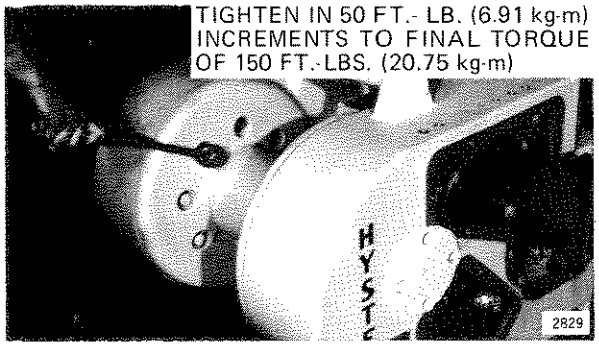
STEP 1. Lubricate R.H. drum shaft bore with Lubriplate or other light lube grease. Install the roller bearing and double-lip seal in the drum, with smooth side to the outside.



STEP 2. Coat the L.H. drum seal ring with O-ring lube. Install new seal ring. Using the sling move the drum into position. Add 1 qt. of oil inside drum cavity.



STEP 3. Install the drum shaft. The drum shaft can be installed by hand, no special tools are required.



STEP 4. Align adapter and drum holes, then install the seven locking dowels and capscrews. Tighten each alternate capscrew in 50 ft.-lbs. (6.91 kg-m) increments until all have evenly reached torque of 150 ft.-lbs. (20.75 kg-m).

FIGURE 5-14. INSTALLATION OF DRUM AND DRUM SHAFT

the vehicle using a different procedure. The bevel gear and brake shaft must be adjusted for 0.000 to 0.004 inch (0.000-0.10 mm) preload.

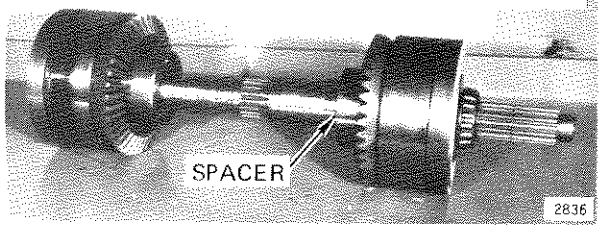
5-47. Installation of Hydraulic Pump.

5-48. Installation of the hydraulic pump is shown in Figure 5-16. Installation can be accomplished with the winch installed on the vehicle. The drive chain must be installed with the cotter pin on the side away from the pump.

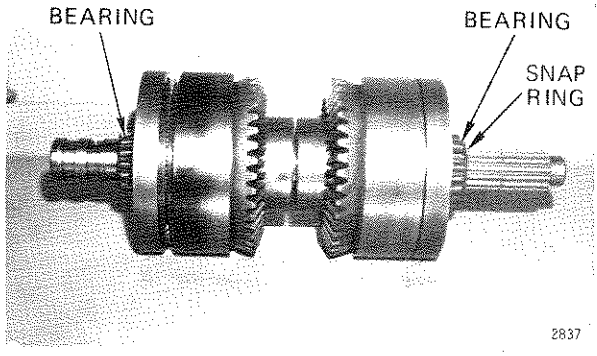
5-49. Reassembly and Installation of Oil Brake Assembly.

5-50. Reassembly and installation of the oil brake is shown in Figure 5-17. Reassembly and installation of the oil brake can be accomplished with the winch mounted on the vehicle. Make sure that the bevel gear and brake shaft has been installed prior to installation of the brake assembly. If new friction discs and separator plates are used, ensure that the stack does not exceed 1.408 inches (3.576mm) in thickness when loaded to 100 pounds, between flat surfaces.

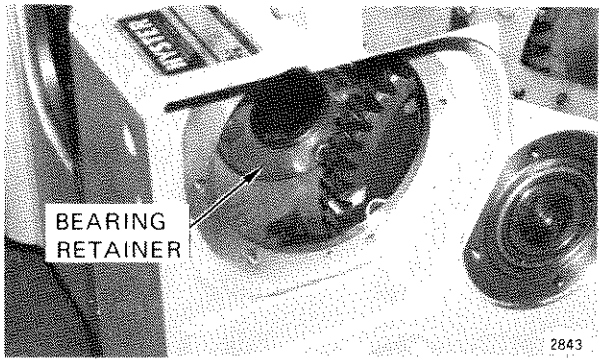
NOTE If it is necessary to replace the internal bearings in the carrier/ bevel ring gear assembly, pre-assemble the bearings and divider spacer before installing on the shaft.



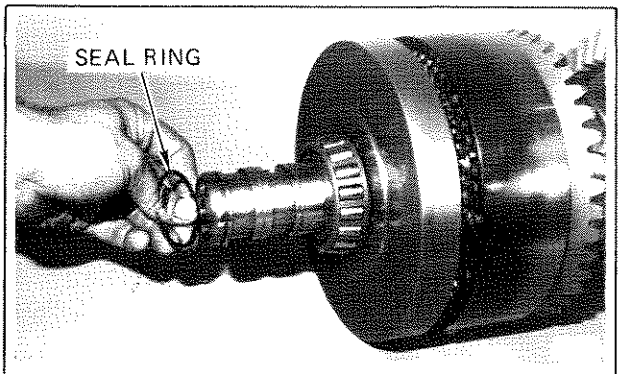
STEP 1. Lube O-rings and Hub. Carefully slide the clutch pack(s) as an assemble, into position on the shaft with the spacer placed next to the carrier/bevel ring gear.



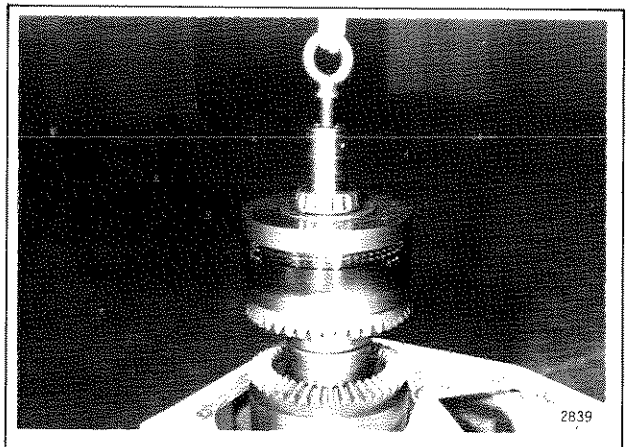
STEP 2. Install the shaft support bearing cones (one on each end of the shaft). Install the inner snap ring on the L.H. end of the shaft.



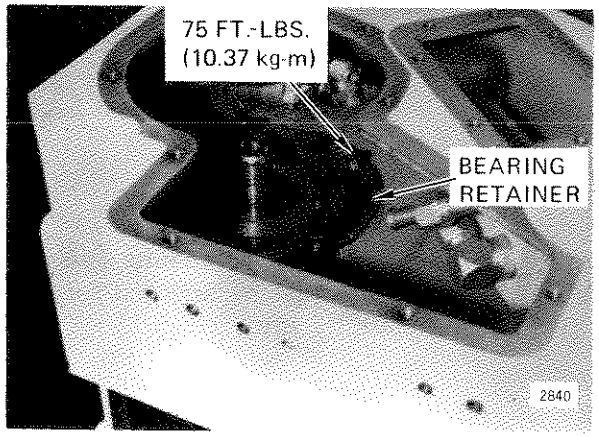
STEP 3. Position the bearing cup in the L.H. bearing retainer. Install the bearing retainer with the shim pack as tagged during removal. Tighten the capscrews snugly but less than final torque.



STEP 4. Install the three cast iron seals rings in the grooves on the R.H. side of the shaft.

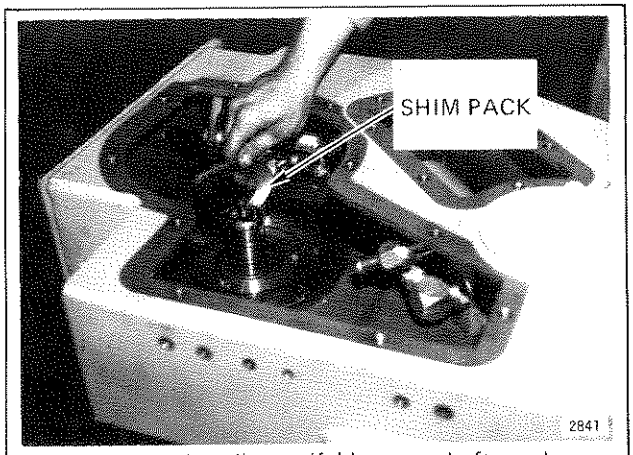


STEP 5. Install the bevel gear and brake shaft, using a 9/16 UNC eyebolt as shown.

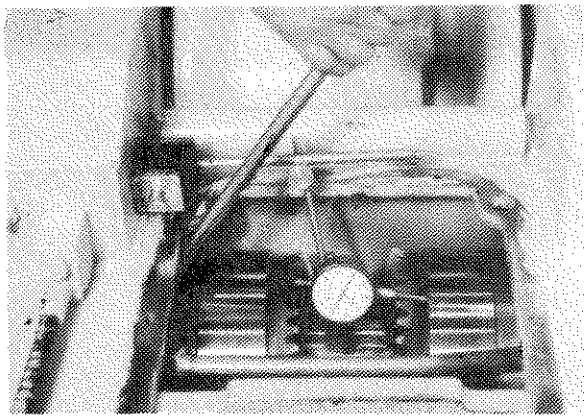


STEP 6. Install the R.H. bearing retainer with the bearing cup installed. Tighten the capscrews to 75 ft.-lbs. (10 kg-m).

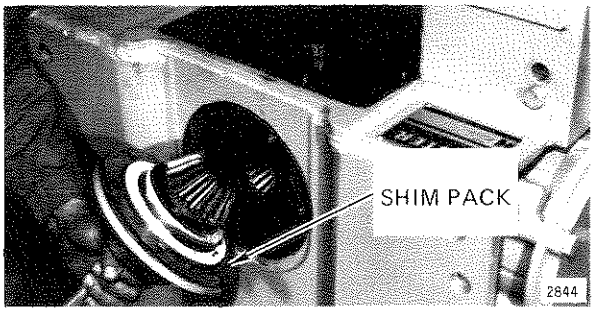
FIGURE 5-15. REASSEMBLY AND INSTALLATION OF BEVEL GEAR AND BRAKE SHAFT ASSEMBLY (Sheet 1 of 3)



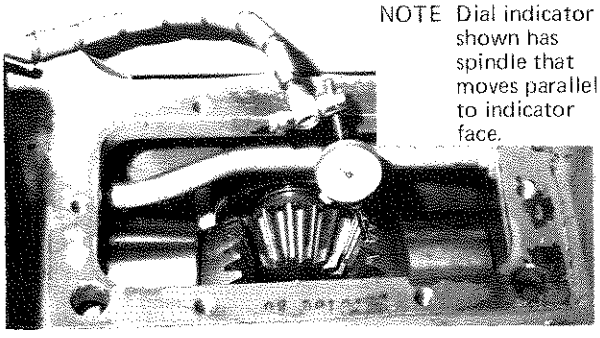
STEP 7. Install manifold over shaft and run capscrews in until snug. Measure gap between manifold and bearing retainer. Add shims to fill gap.



STEP 8. Install the L.H. bearing retainer without shims. Measure gap between retainer and winch case. Add enough shims to fill the gap. Put a dial indicator against machined edge of clutch carrier where the gear is bolted on. Use a prybar to move the clutch carrier from side to side. Adjust the number of shims to create .000 to .004 in (0.00 to 0.10 mm) preload.

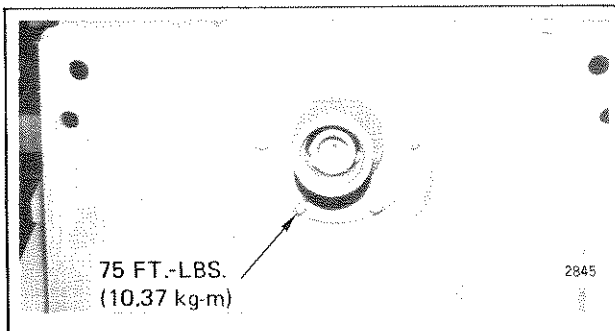


STEP 9. Install original shim pack on the PTO shaft. Install shaft and secure with two capscrews. Using a dial indicator on the bevel gears check bevel pinion for centering between the two bevel gears. The bevel pinion is centered when there is equal backlash on both bevel gears. Move shims between the oil manifold and L.H. bearing retainers to center the pinion (DO NOT add or remove any shims.)



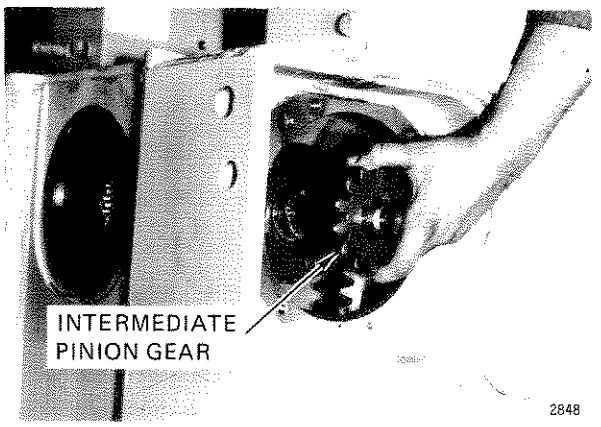
NOTE Dial indicator shown has spindle that moves parallel to indicator face.

STEP 10. Using a dial indicator on bevel gears check bevel gear backlash which should be 0.006-0.012 (0.05-0.25 mm). Add shims to PTO shaft carrier to increase the backlash and remove shims to decrease backlash.



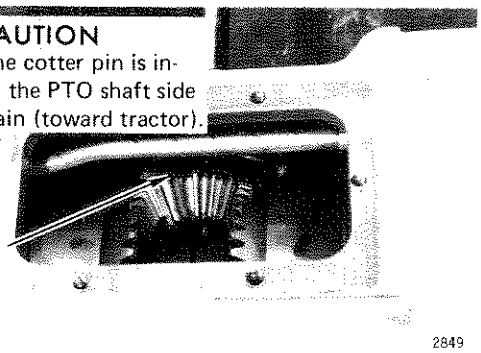
STEP 11. Tighten the hardware on the PTO shaft carrier, L.H. bearing retainer and the oil manifold to 75 ft.-lbs. (10 kg-m) torque.

FIGURE 5-15. REASSEMBLY AND INSTALLATION OF BEVEL GEAR AND BRAKE SHAFT ASSEMBLY (Sheet 2 of 3)



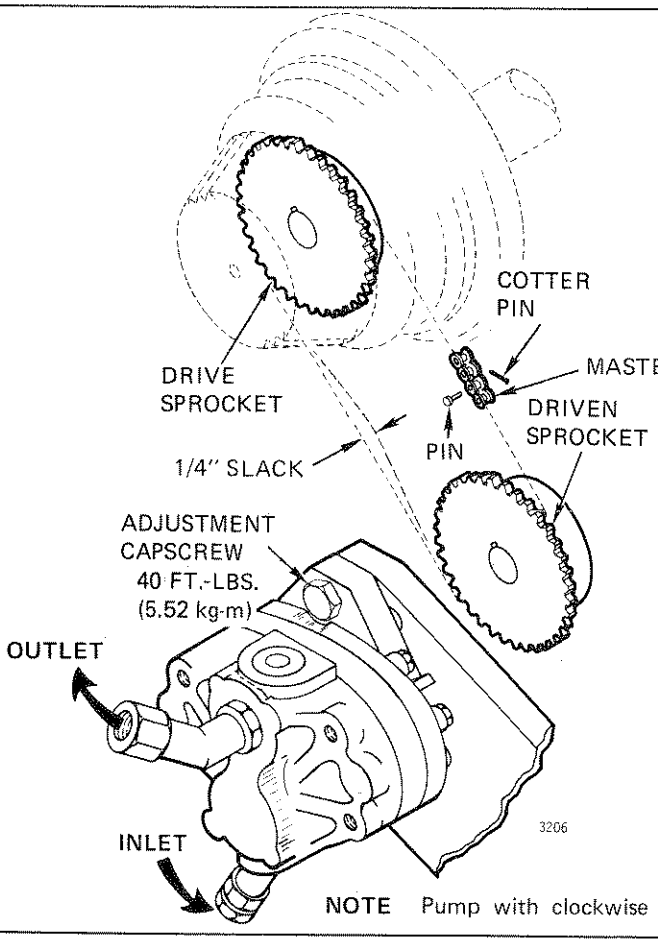
STEP 12. Install the intermediate pinion gear, snap rings and spacer (one snap ring on each side of the gear).

CAUTION
Be sure the cotter pin is installed on the PTO shaft side of the chain (toward tractor).



STEP 13. Loosen the pump adjustment capscrew and rotate the pump toward the PTO shaft. Install the chain, on the drive sprockets. Install master link. Adjust pump as described in Figure 5-16.

FIGURE 5-15. REASSEMBLY AND INSTALLATION OF BEVEL GEAR AND BRAKE SHAFT ASSEMBLY (Sheet 3 of 3)



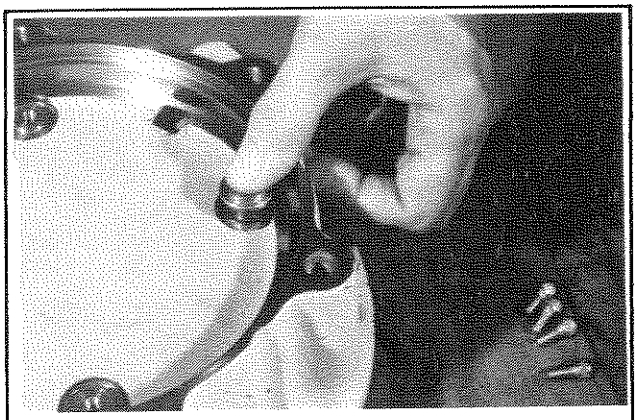
STEP 1. Position pump against mounting flange and loosely install capscrews.

STEP 2. Position chain on sprockets. Connect master link as shown. Pull pump tight to remove all but 1/4" slack from chain and tighten the two capscrews to 40 ft.-lbs. (5.52 kg-m) torque. Connect hydraulic hoses.

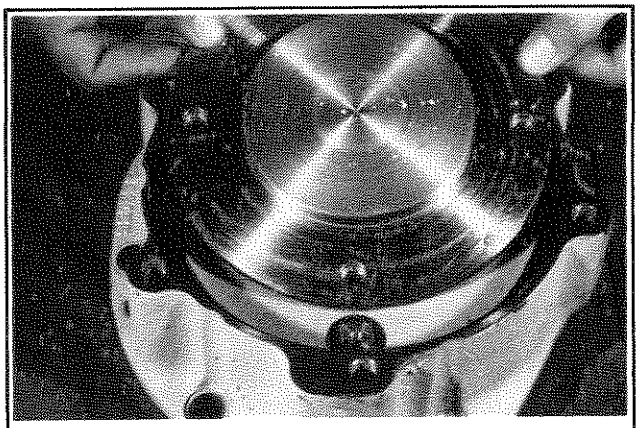
IMPORTANT NOTE:
Be sure cotter pin or clip is installed on PTO shaft side of chain. Closed ends of cotter pin and clip links must be pointed in the direction of rotation.

NOTE Pump with clockwise rotation shown.

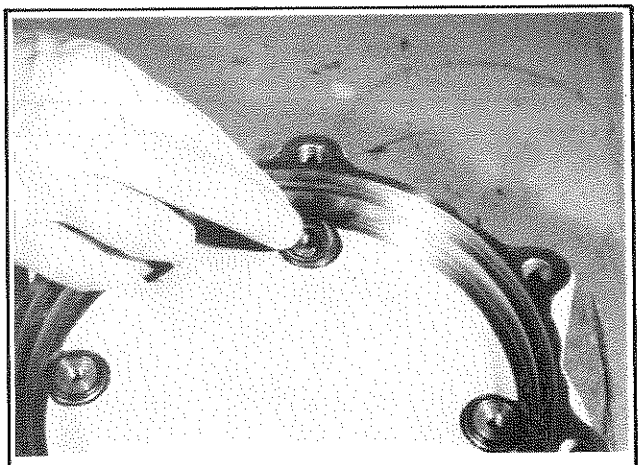
FIGURE 5-16. INSTALLATION OF HYDRAULIC PUMP



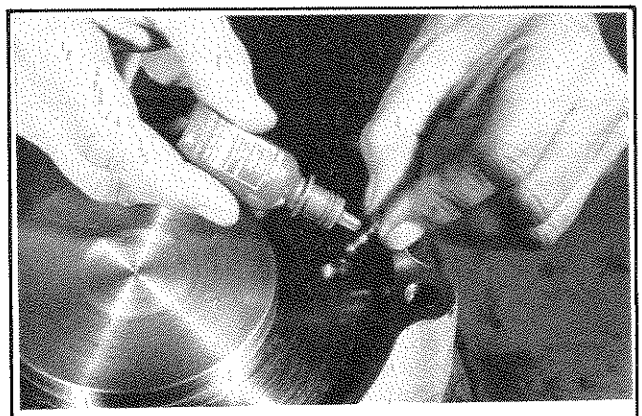
STEP 1. Install a new O-ring on the plungers. Lubricate the O-ring with clean hydraulic oil and install into the bore.



STEP 4. Align the piston over the threaded holes in the plungers. Push the piston into the housing. Do not cut the seal.

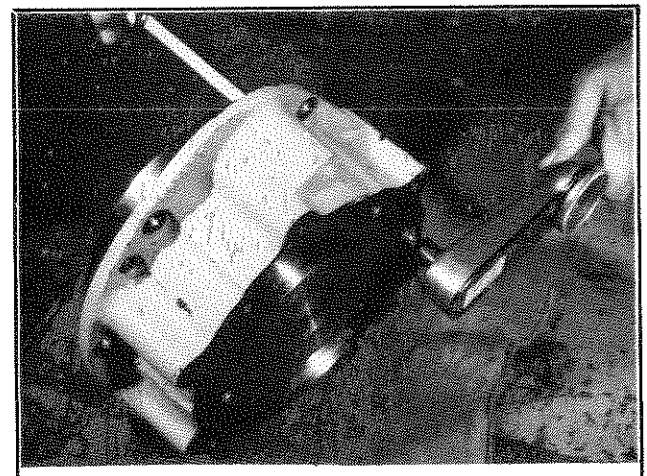


STEP 2. Install a new O-ring on the top of each plunger.



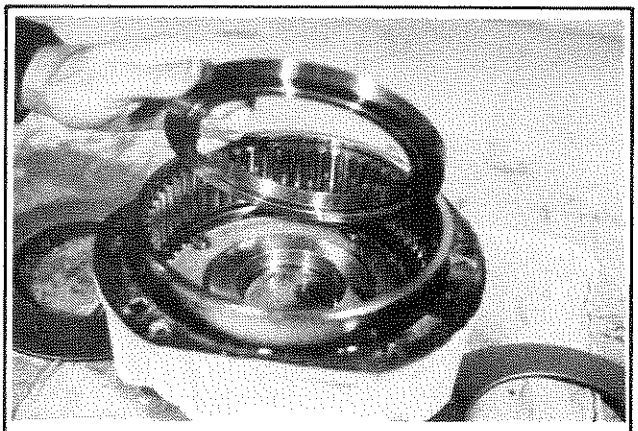
STEP 5. Put #271 (red) Locktite on the Allen head capscrews. Install the capscrews in the plungers one at a time.

STEP 3. Install a new seal on the piston and apply a thin layer of clean oil or lubricant.

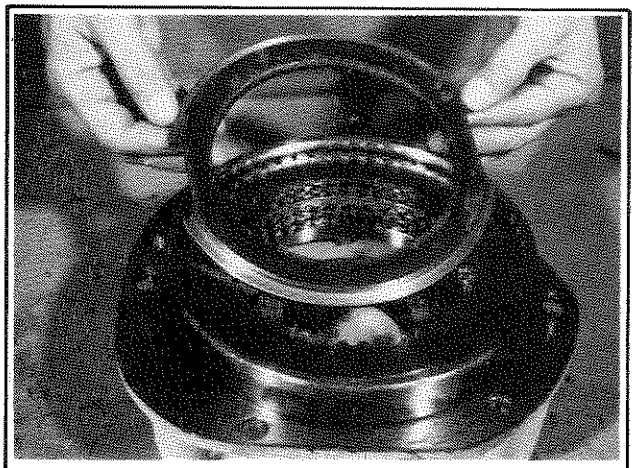


STEP 6. Tighten the Allen head screws to a torque of 25 in lbs (3 N.m).

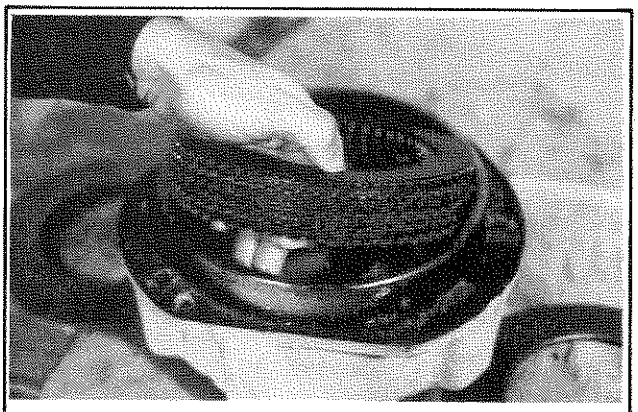
FIGURE 5-17. REASSEMBLY AND INSTALLATION OF OIL BRAKE ASSEMBLY (Sheet 1 of 4)



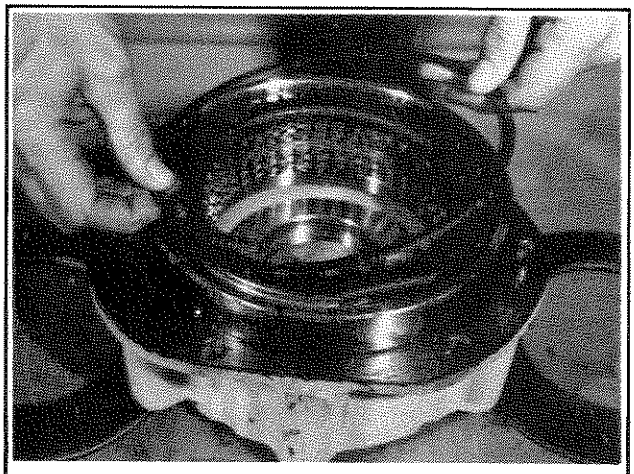
STEP 7. Use the two brake springs as a support for the brake housing. Install the thrust ring with the groove toward the inner face.



STEP 9. Install the pressure ring with the smooth surface toward the friction disc. The notches are aligned with the spaces on the friction discs.

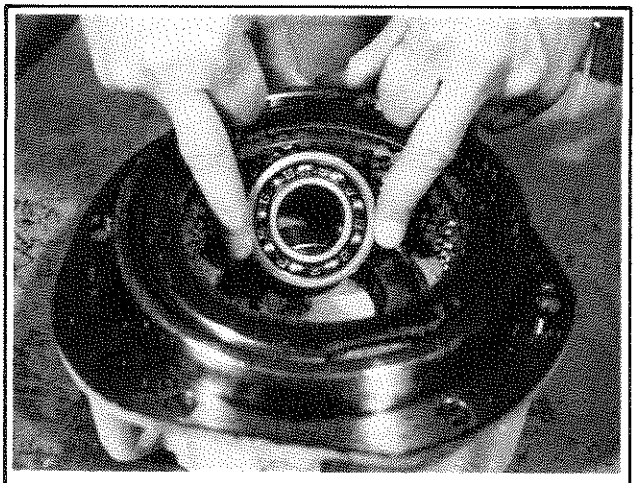


STEP 8. Install the brake discs. Start with a friction disc, then a separator disc. Change the installation from a friction disc to a separator disc until the five friction discs and the six separator discs are installed. Align the spaces on the separator discs that do not have teeth.

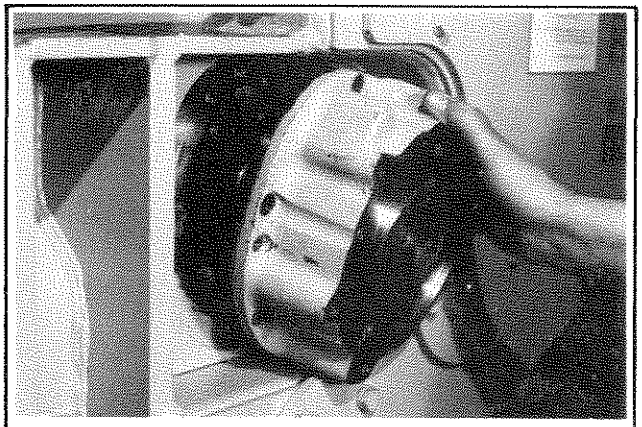


STEP 10. Install the snap ring in the groove of the housing. Start the end of the snap ring in the notch of the pressure ring. If necessary, apply a force to the pressure plate to give clearance to install the snap ring.

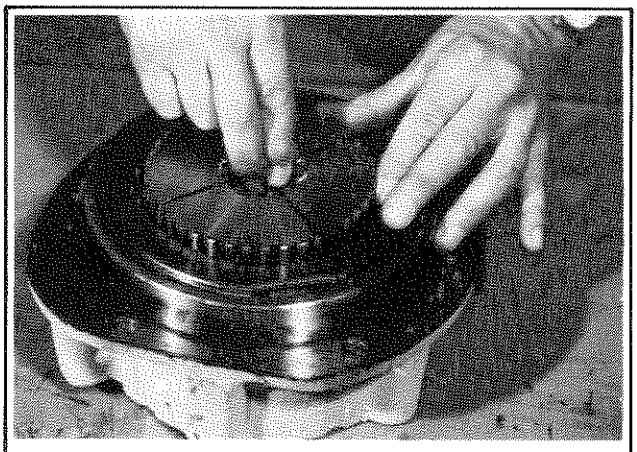
FIGURE 5-17. REASSEMBLY AND INSTALLATION OF OIL BRAKE ASSEMBLY (Sheet 2 of 4)



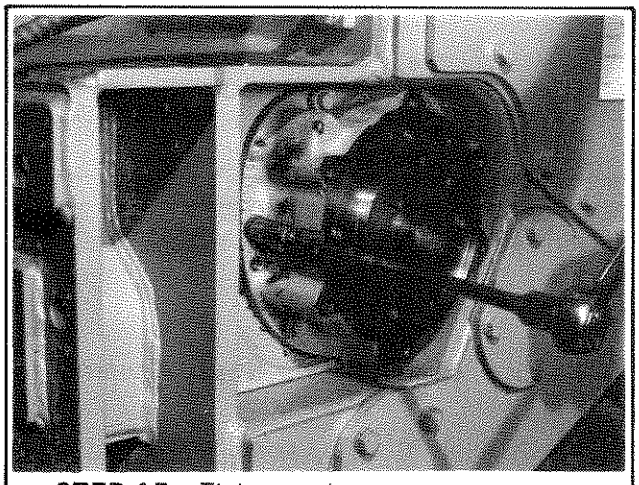
STEP 11. Install the bearing into the bore of the housing.



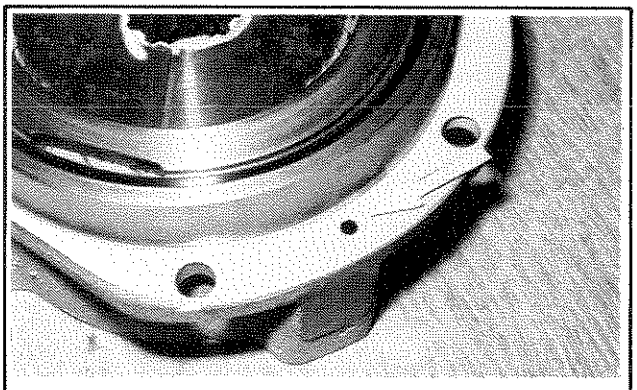
STEP 14. Install the brake housing assembly on the brake shaft. Do not install the brake cover. The brake hub must be able to move.



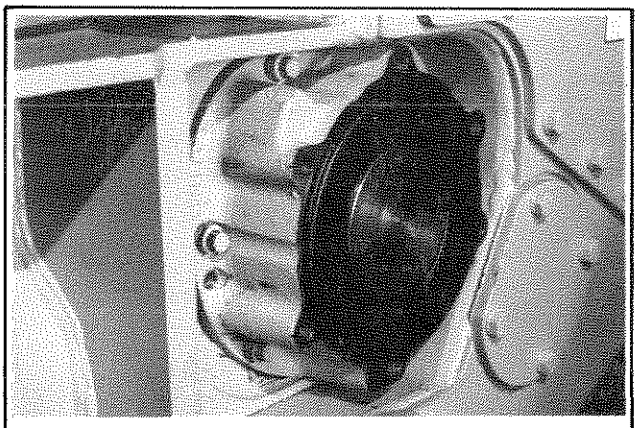
STEP 12. Align the inside teeth of the separator discs and install the hub.



STEP 15. Tighten the capscrews to a torque of 75 ft lb (100 N.m).

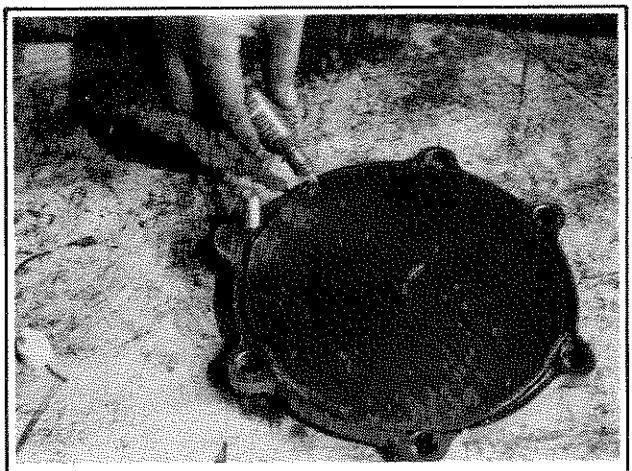


STEP 13. Apply gasket cement to the mounting flange. Install the gasket against the flange. Do not get any cement in the hole that drains the oil.

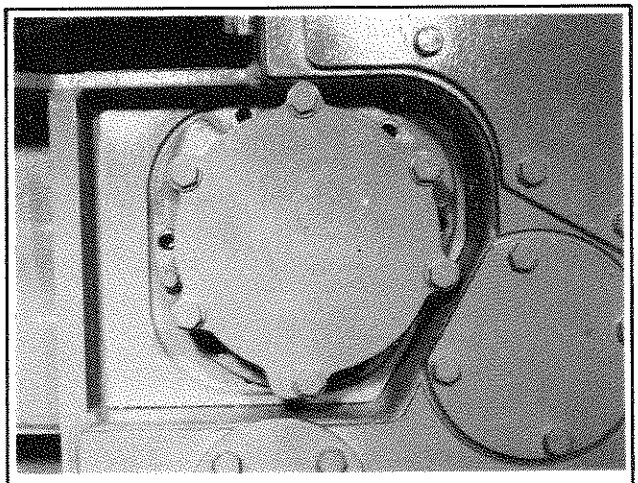


STEP 16. Install the two Belleville springs so that the inside diameter is toward the piston. They will hang on the piston.

FIGURE 5-17. REASSEMBLY AND INSTALLATION OF OIL BRAKE ASSEMBLY (Sheet 3 of 4)



STEP 17. Put number 271 (red) Locktite on both sides of the brake housing shims and install the cover. Install the other capscrews on the top of the brake assembly to hold the shims in the correct position. Install the remainder of the capscrews.



STEP 18. Tighten the capscrews on the cover to a torque of 75 ft lb (100 N.m).

FIGURE 5-17. REASSEMBLY AND INSTALLATION OF OIL BRAKE ASSEMBLY (Sheet 4 of 4)

5-51. Installation of PTO Shaft Assembly.

5-52. Reassemble the PTO assemblies as shown in figure 5-19.

5-53. Installation of Suction Filter.

5-54. Installation of the suction filter is shown in Figure 5-18. Install a new cover gasket on the suction filter to avoid loss of pump suction. Never use old gaskets. Tighten the four capscrews to 75 foot-pounds (10.37 kg-m) torque.

5-55. WINCH INSTALLATION.

5-56. Preparation.

a. Clean the mounting surfaces on the vehicle and winch.

b. Check the condition of the mounting studs on the vehicle. Ensure that all studs are tight. Replace any studs that are loose, bent or otherwise damaged. Minor thread damage may be dressed with a thread chaser.

c. Loctite all studs.

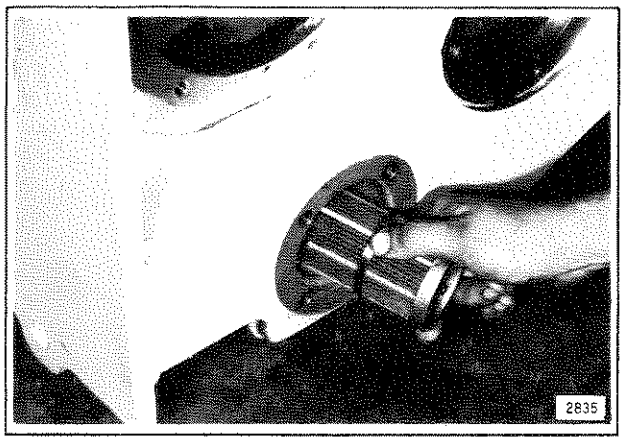


FIGURE 5-18. INSTALLATION OF SUCTION FILTER

d. Install mounting adapter if required.

e. Install O-ring over PTO shaft carrier.

f. Assemble coupling on PTO shaft.

CAUTION Be sure pin and lock ring are securely installed in PTO coupling.

5-57. Installation.

5-58. Installation of the winch is shown in Figure 5-20. Observe the following during installation:

WARNING Before raising the winch into position, ensure that the lifting device is in safe operating condition and has a rating of at least 3,000 pounds (1360 kg).

a. Attach sling or cable around drum.

b. Raise the winch and align the splines on the tractor PTO with the splines of the PTO coupling.

c. Align the studs with the mounting holes to prevent thread damage.

d. Loosely install the two, top nuts before the winch is fully seated against the tractor.

e. Secure the winch in place using the parts listed in the mounting kit instructions. Tighten the nuts alternately at each side of the winch to pull the winch evenly against the tractor. Torque all nuts and capscrews as specified in mounting kit instructions.

f. Install control lever assembly per mounting kit instructions.

g. Attach push-pull cable(s) to control lever assembly.

h. Attach cable bracket(s) to winch. Do not tighten fasteners at this time.

i. Attach push-pull cable(s) to valve and free spool, then tighten cable bracket(s) to winch.

j. Check hydraulic oil level.

k. Adjust control cable and check hydraulic pressure settings as described in Section 4.

l. Attach pressure gauge hose to the fitting on the winch.

NOTE Pressure checks should be taken with hydraulic oil at operating temperature. Run winch in Brake-Off position to raise temperature.

- Install a new seal Item 2 in carrier item 3. Add new O-ring item 4. Install new bearing item 6 into carrier.

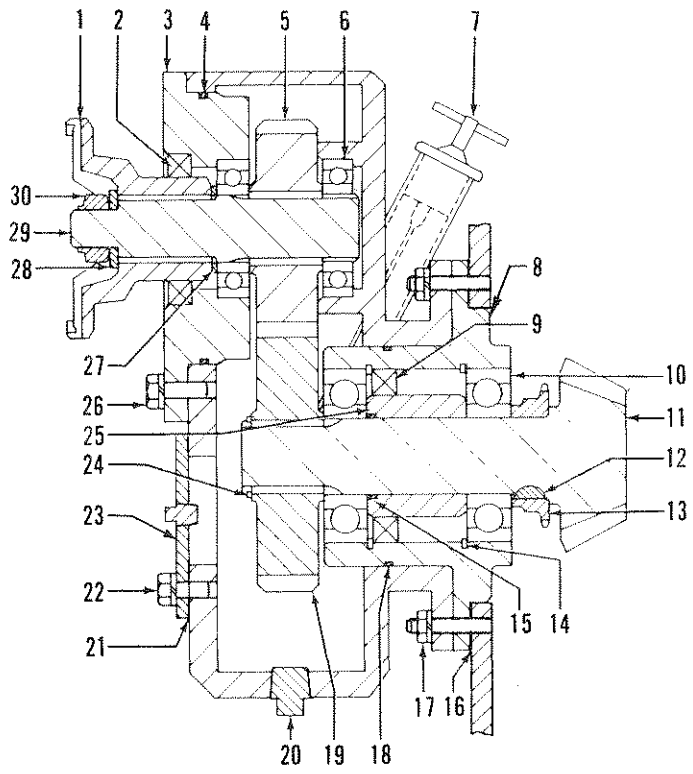
- Clamp the large splined end of shaft item 29 in soft vise jaws. Slide the carrier onto the shaft until bearing item 6 is against the splines. Install spacer item 27. Lubricate the yoke item 1 with oil and slide it onto shaft. Add washer item 28 and nut item 30. Tighten the nut to 75 ft. lbs. torque.

- Put gear item 9 into gearcase. Remove shaft item 29 from the vise and install gear item 5. Install a new bearing item 6 into the case. Add lubricant to O-ring item 4. Hit the end of shaft item 29 to drive the shaft into the rear bearing. Install capscrews item 26 and lockwashers. Tighten the capscrews to 75 ft. lbs. torque.

- Install a new seal item 19 into retainer item 8. The seal lip should face out. Install snapring item 14. Install the outer bearing item 10 into the retainer item 8. Install pinion shaft item 11 through bearing item 10. Lubricate the exterior of seal sleeve item 25 and install it over the shaft. The O-ring groove must face up. Add O-ring item 15 into the groove. Install the inner bearing item 10 into the retainer.

- Put a new O-ring item 18 onto retainer item 8. Lubricate the case bore for the O-ring. Push the completed retainer assembly into the case bore. Align the gear splines item 19 with the pinion item 11. Push the gear onto the pinion. Install snapring item 24.

- Install a new gasket item 21 and cover item 23. Tighten the cover capscrews item 22 to 75 ft. lbs. Tighten nuts item 17 to 75 ft. lbs.



1. Yoke
2. Seal
3. Carrier
4. O-ring
5. Gear
6. Bearing
7. Dipstick
8. Bearing Carrier
9. Seal
10. Bearing
11. Pinion Shaft
12. Woodruff Key
13. Drive Sprocket
14. Snapring
15. O-ring
16. Shim Pack
17. Nut
18. O-ring
19. Gear
20. Drain Plug
21. Gasket
22. Capscrew
23. Cover
24. Snapring
25. Seal Sleeve
26. Capscrew
27. Spacer
28. Washer
29. Shaft
30. Nut

FIGURE 5-19. REASSEMBLY OF PTO ASSEMBLY FOR D45 KOMATSU (Sheet 1 of 4)

- Install new bearings item 3 into retainer item 1. The sealed side should be facing each other. Insert pinion shaft item 5 through both bearings. Install gear item 27, spacer item 26, and snapring item 25. Add a new O-ring item 7. Add shims item 9 between retainer item 1 and the winch case to produce .006 to .012'' backlash. Tighten capscrews item 8 to a torque of 75 ft. lbs.

- Install a new lower rear bearing item 11. Put a gear item 12 into the case through the upper opening.

- Hit PTO shaft item 18 into bearing item 11. Install the outer bearing item 11.

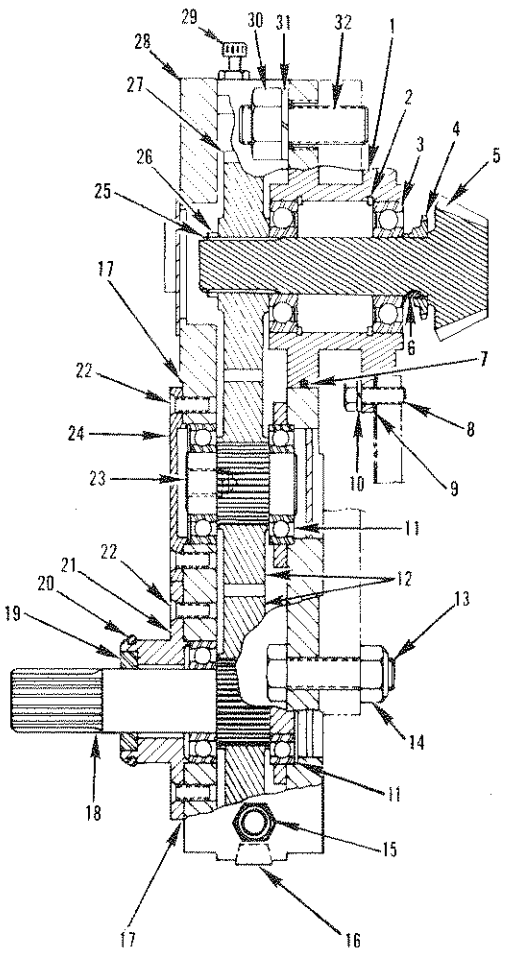
- Install a new seal item 19 into retainer item 21. Place a new gasket item 17 against the gearbox. Install the retainer and tighten the countersunk capscrews item 22 to a torque of 25 ft. lbs.

- Install a new bearing item 11 into the case bore. Put the second gear item 12 into the case through the upper opening. The threaded puller hole should face outward. Install the second bearing item 11.

- Place a new seal item 19 against the winch case. Install the cover item 21 and tighten the capscrews to a torque of 75 ft. lbs.

- Add lubricant to the upper bore and carefully position the gearbox onto retainer item 1. Tighten hardware items 13, 14, 30.

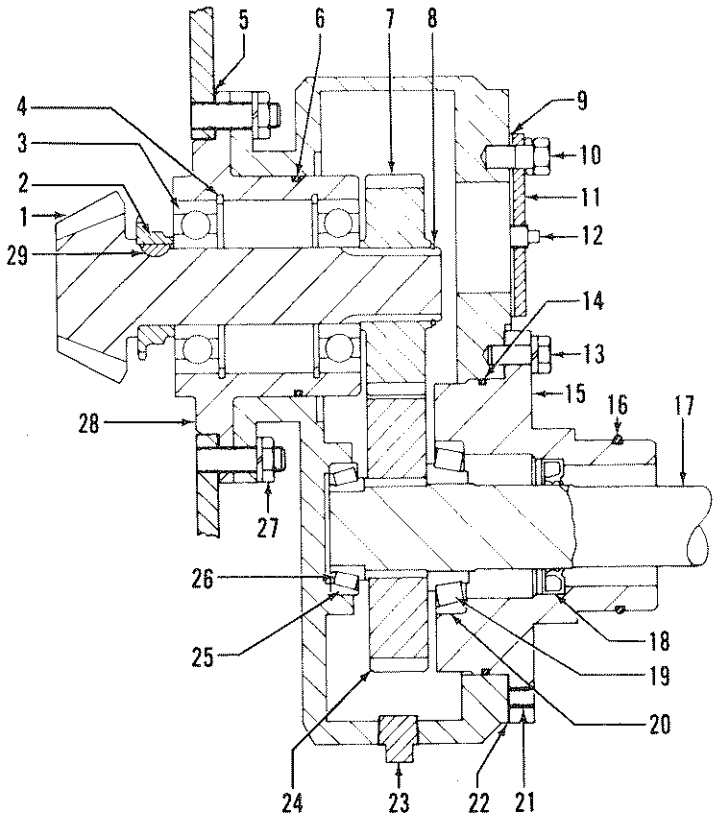
- Add oil in gearbox until sight glass is covered with oil.



1. Retainer
2. Snapring
3. Bearing Sealed
4. Drive Sprocket
5. Pinion Shaft
6. Woodruff Key
7. O-ring
8. Capscrew
9. Shims
10. Lockwasher
11. Bearing
12. Gear
13. Capscrew
14. Nut
15. Sightglass
16. Drain Plug
17. Gasket
18. PTO Shaft
19. Seal
20. O-ring
21. Retainer
22. Capscrew
23. Shaft
24. Cover
25 Snapring
26. Spacer
27. Gear
28. Gearbox
29. Breather
30. Nut
31. Lockwasher
32. Stud

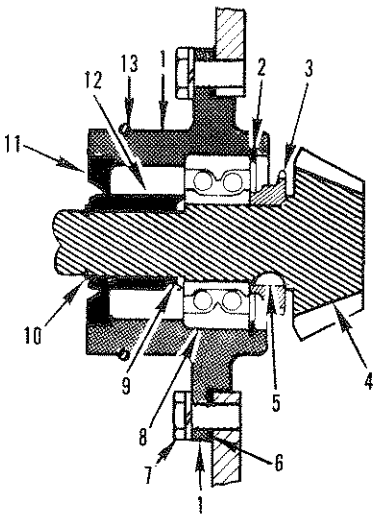
FIGURE 5-19. REASSEMBLY OF PTO ASSEMBLY FOR FIAT 8, FL9, AND 10 (Sheet 2 of 4)

- Install new bearings item 3 and snapring item 4 into carrier item 1.
- Lubricate shaft item 1 and press into bearings item 3. Add gear item 7 and snapring item 8.
- Add O-ring item 6 to carrier item 28. Lubricate O-ring item 6 and slide carrier into the housing.
- Install a new gasket item 9 and tighten capscrews item 10 to a torque of 75 ft. lbs.
- Install a new bearing cup item 25 into the case.
- Install a new seal item 18 into carrier item 15. Install a new bearing cup item 20 also.
- Install a new bearing cone item 19 onto shaft item 17. Insert shaft item 17 into carrier item 5.
- Install gear item 24 onto shaft item 17. Add bearing cone item 26 onto the shaft.
- Install a new O-ring item 14 onto carrier item 15. Add lubricant to the O-ring and install item 15. Measure the clearance between item 15 and the winch case. Make up a shim pack item 22 so that the bearings have .000 to .004 endplay.
- Add enough shims item 5 to produce backlash of .006 to .012 between both level gears.
- Tighten nuts item 27 to a torque of 75 ft. lbs.



1. Pinion Shaft
2. Drive Sprocket
3. Bearing
4. Snapring
5. Shim
6. O-ring
7. Gear
8. Snapring
9. Gasket
10. Capscrew
11. Cover
12. Plug
13. Capscrew
14. O-ring
15. Retainer
16. O-ring
17. PTO Shaft
18. Seal
19. Bearing Cone
20. Bearing Cup
21. Threaded Hole
22. Shim Pack
23. Drain Plug
24. Gear
25. Bearing Cup
26. Bearing Cone
27. Capscrew
28. Carrier
29. Woodruff Key

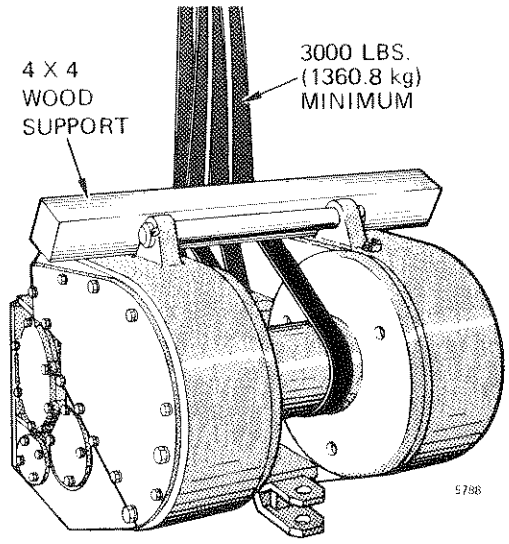
FIGURE 5-19. REASSEMBLY OF PTO ASSEMBLY FOR D4 CAT (Sheet 3 of 4)



1. Bearing carrier
2. Snapring
3. Drive sprocket
4. Pinion shaft
5. Woodruff key
6. Shim pack
7. Capscrew
8. Bearing
9. O-ring
10. Snapring
11. Seal
12. Seal sleeve
13. O-ring

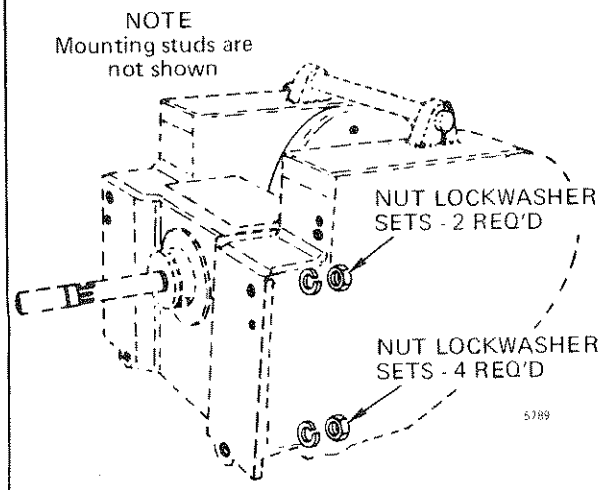
- Install a new seal item 11 into carrier item 1.
- Install a new bearing item 8 into carrier item 1.
- Lubricate shaft item 4 and install into the carrier.
- Install O-ring item 9 onto PTO shaft.
- Install seal sleeve item 12 with the O-ring bore against the O-ring.
- Install snap ring item 10
- Add enough shims item 6 between the carrier item and the case to produce .006 to .012" backlash.
- Tighten capscrews item 7 to a torque of 75 ft. lbs.

FIGURE 5-19. REASSEMBLY OF THE PTO ASSEMBLY FOR CAT D3, HD6, AND MF D400C
(Sheet 4 of 4)

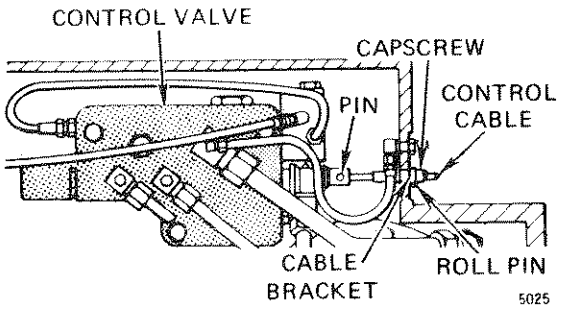


STEP 1. Attach lifting device to winch. Winch will be balanced when connected as shown.

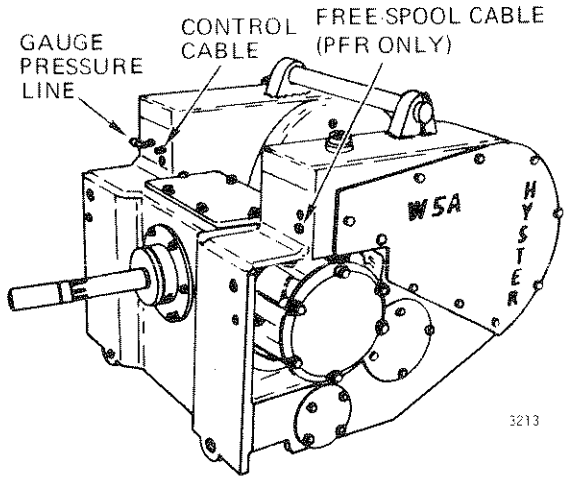
WARNING Make sure that the lifting device has a minimum capacity of 3,000 pounds (1360.8 kg) before lifting the winch.



STEP 2. Loctite all studs. Align the holes in the mounting pads with the studs and loosely install two nuts (or capscrews) on top before the winch is fully seated against the tractor. Tighten the nuts (or capscrews) alternately at each side of the winch to pull winch evenly against the tractor. All nuts should be tightened to 500 ft.-lbs. (69.15 kg-m) torque.



STEP 3. Attach push-pull cable(s) to the control valve and free spool. Then tighten the cable bracket capscrew, fill unit with oil, then adjust cable and hydraulic pressure as described in Section 4.



STEP 4. Connect gauge pressure line. Install cover plates.

FIGURE 5-20. WINCH INSTALLATION

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HYSTER COMPANY
TRACTOR ATTACHMENT OPERATIONS

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